PMM

Precision Metal Molding

INCLUDING DIE CASTINGS MAGAZINE

JUNE
1955

devoted exclusively to:

DIE CASTINGS

INVESTMENT CASTINGS

ERMANENT MOLD CASTINGS

PLASTER MOLD CASTINGS

POWDER METALLURGY

SHELL MOLD CASTINGS

"In Pinspotters for bowling alleys, we use die castings, shell mold castings and permanent mold castings . . ."
See page 3
Dean Richman
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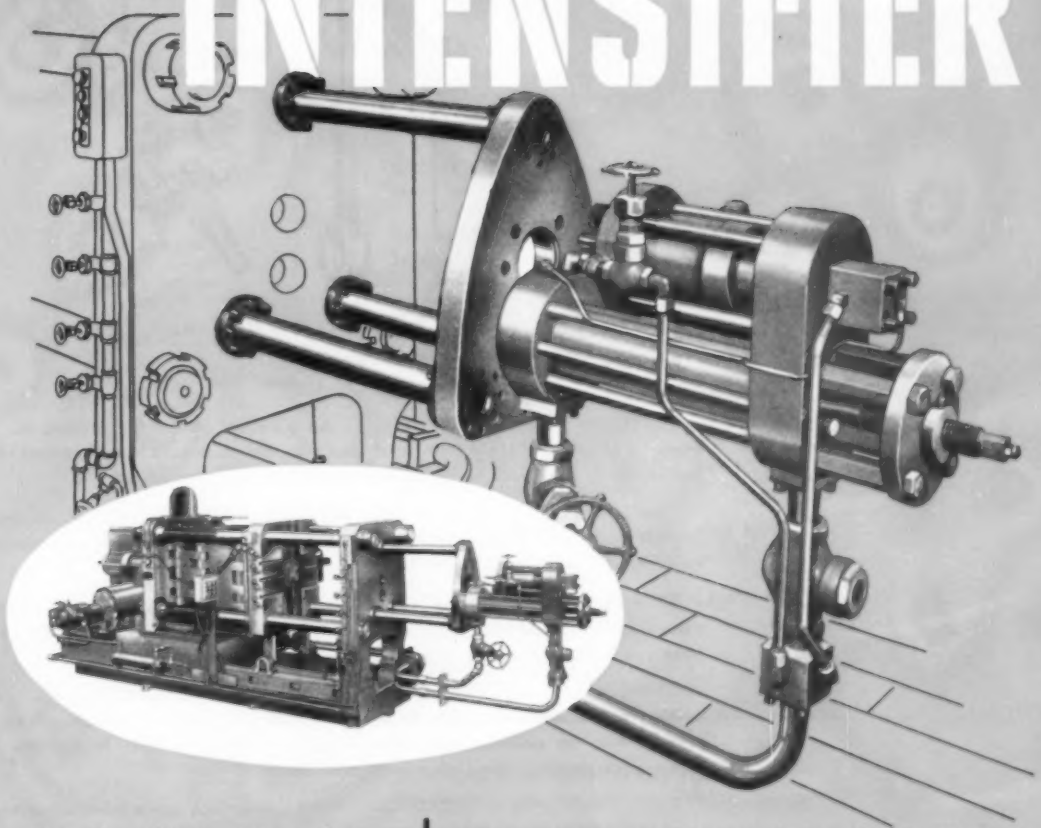

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PMM

June 1955

Volume 13 Number 6

Precision Metal Molding

DIE CASTINGS
INVESTMENT CASTINGS
PLASTER MOLD CASTINGS
PERMANENT MOLD CASTINGS
POWDER METALLURGY
SHELL MOLD CASTINGS

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How Twin City Die helped Donaldson cut pre-cleaner costs 33%

This collector pre-cleaner fits on the intake tube of the oil-bath air cleaner. It removes most of the dirt in the air before it enters the air cleaner itself.

...made one die serve 3 diameters

Want to make die casting pay you better? Here's how Twin City Die worked with the customer's engineers to drop production costs for the Donaldson Company of St. Paul:

Welding operations on the intake vanes for this Donaldson collector pre-cleaner snagged production . . . held costs up. Die casting offered a way to eliminate welding, but three different diameters of the center tube were necessary. Use of a separate die for each diameter would send costs climbing again.

In cooperation with Donaldson engineers, Twin City Die Casting succeeded in using replaceable cores to cast all three diameters with the same die. Donaldson gained all the advantages of high-volume, high-speed die casting together with the lowest possible die costs. Net result: Production costs were cut 33%.

This Donaldson pre-cleaner is just one example of how Twin City engineers and die casters make die casting pay you better. Oldest die caster in the Upper Midwest, Twin City keeps its leadership because of its willingness and ability to develop new ideas and new methods to solve your problems.

Get the facts! Send us samples of blueprints and let us demonstrate Twin City service to you!

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DIE CASTINGS IN HEAT PUMPS

I am sure that you are already familiar with the heat pump which is described in the attached article. As the photograph in the article illustrates, this is a complex piece of machinery requiring a great number of components.

A question has arisen as to whether or not die castings of various sorts are employed in the assembly of a typical pump. Could you give us any information on the subject? Do you, for example, know if die cast parts are used or if not, whether there is potential application for them?

I'd appreciate any information you could give us on this subject.—H.H.S. (Executive Vice President)

The article describes typical heat pump systems for home heating and cooling, pointing out that ultimately, these heat pumps will heat homes at a cost comparable to the cost of fuel oil, gas or coal, and will, in addition, "supply hot water, running ice water, handle all food refrigeration, take care of low temperature cooking and store heat for use when needed." They need no chimneys, all windows can be permanently sealed, dusting in the home will be eliminated, etc.

The answer to the question is that, while we are not familiar with the details of any of these specific heat pumps, it is easy to recognize typical applications for die castings in this equipment. Probable uses for die castings, some in zinc and some in aluminum alloy, include: pump impellers, blower housings, ventilator hardware, motor components such as endbells and rotors, compressor housings, thermostat housings, pulleys and other drive elements.

Six companies are known to make "packaged" heat pumps. These glorified refrigeration systems use standard compressors that commonly have die cast parts such as housings. Among "special" components, the mixing valves may be potential die casting applications.
—Ed.

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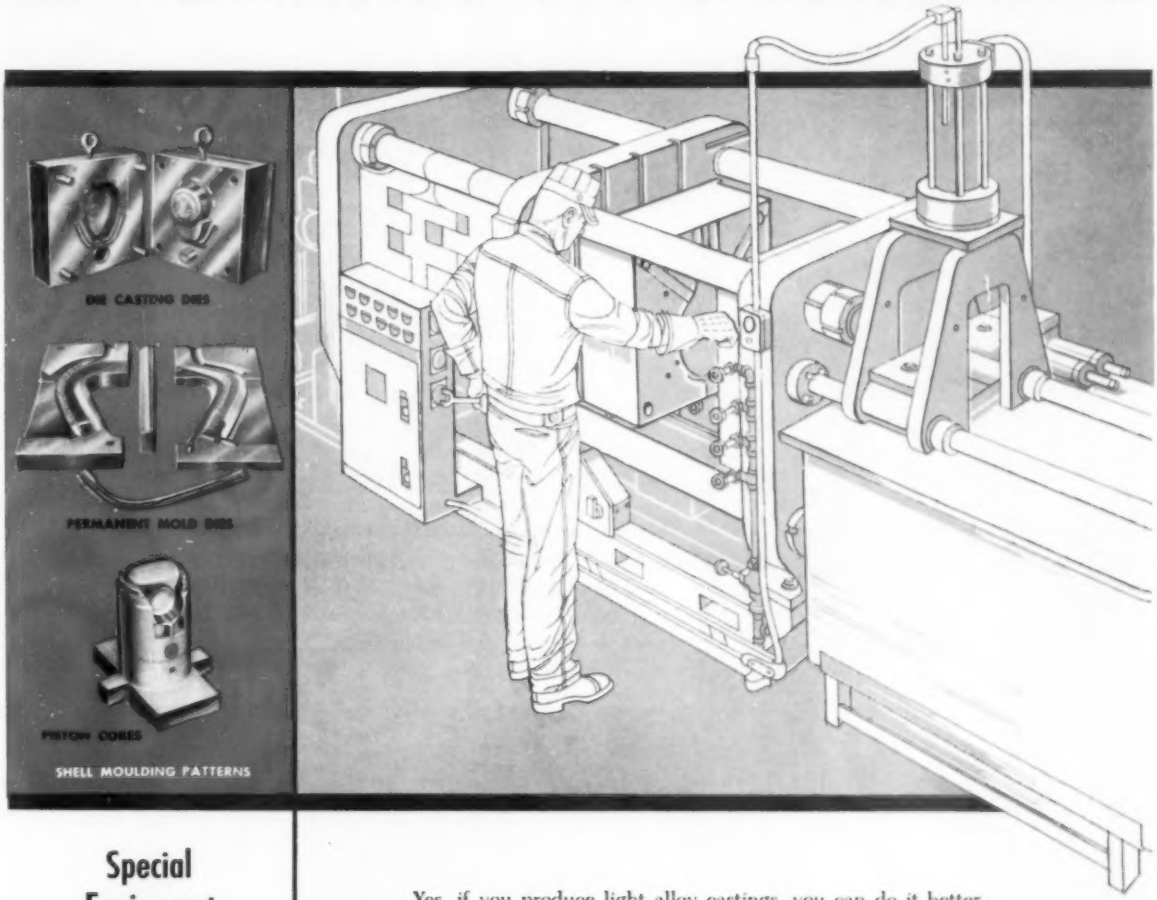

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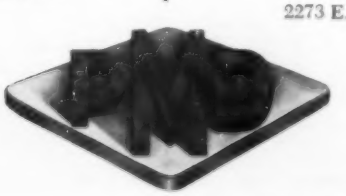

WRITE TODAY FOR YOUR COPY OF THIS NEW PMD REFERENCE CATALOG!

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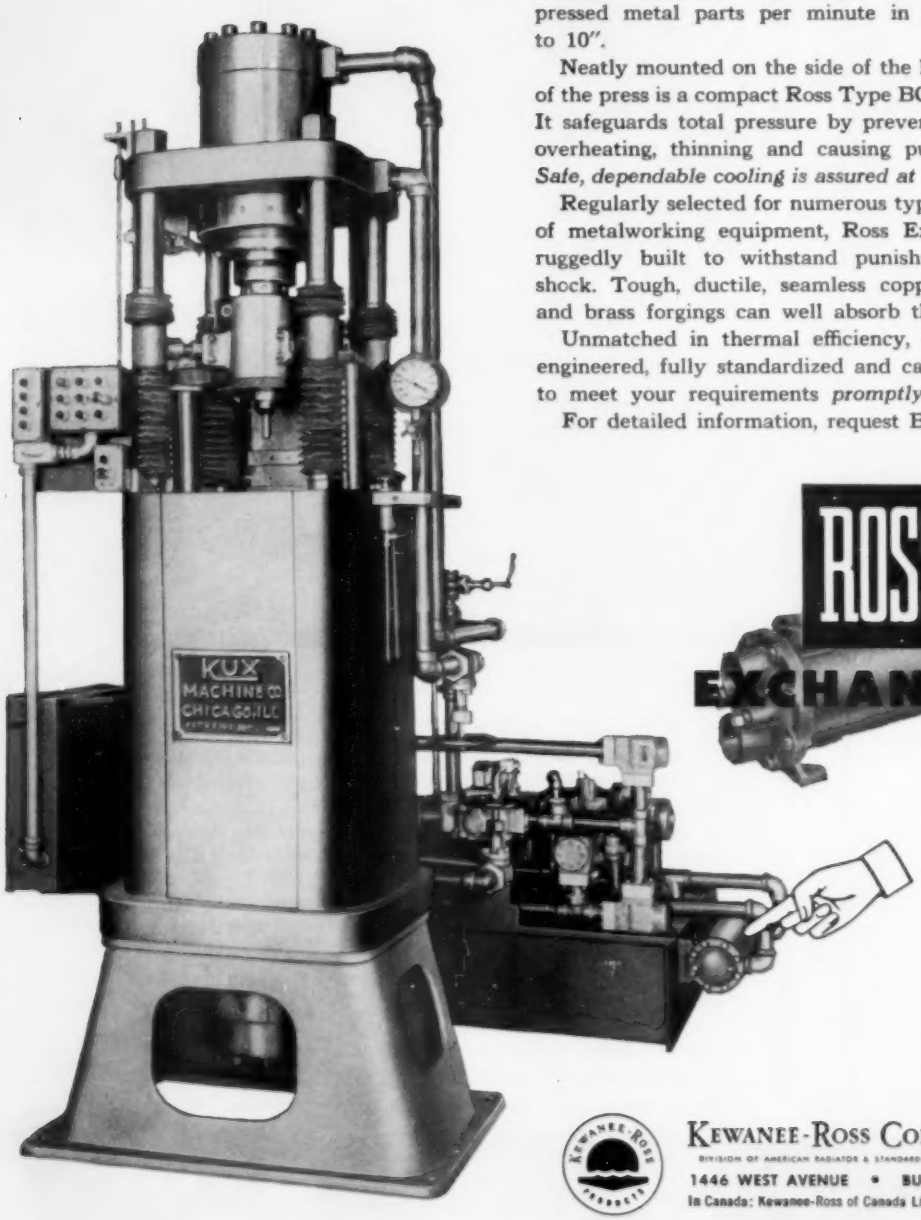
Ross Exchanger safeguards total pressure of this new 100-ton Kux Powder Metal Press



Featured as a *new* press in the Kux "Big 4 Hydraulic Series," this 100-ton Kux Powder Metal Press (Model 4100) has been designed to form 15 compressed metal parts per minute in diameters up to 10".

Neatly mounted on the side of the hydraulic unit of the press is a compact Ross Type BCF Exchanger. It safeguards total pressure by preventing oil from overheating, thinning and causing pump slippage. *Safe, dependable cooling is assured at all times!*

Regularly selected for numerous types and makes of metalworking equipment, Ross Exchangers are ruggedly built to withstand punishing hydraulic shock. Tough, ductile, seamless copper-alloy shell and brass forgings can well absorb the extra load.

Unmatched in thermal efficiency, they are pre-engineered, fully standardized and carried in stock to meet your requirements *promptly*.

For detailed information, request Bulletin 1.1K5.

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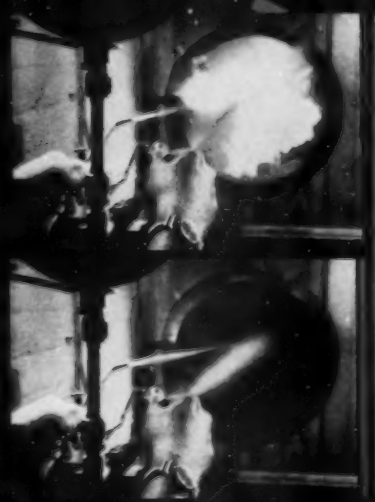
HYDRAULIC DANGER ZONE

Ordinary hydraulic fluid, escaping under pressure, can start a fire 40 ft. or more from a broken line! Is your plant safe? Here's how one firm protects men and machines inside the danger zone . . .

MEN POUR MOLTEN ZINC JUST 4 FT. AWAY FROM SAFE PYDRAUL LINES

PEAT MANUFACTURING CORP., NORWALK, CALIF., now uses fire-resistant Pydraul F-9 hydraulic fluid in 6 die-casting machines. Two years ago, ordinary fluid started a plant fire. But recently, when Pydraul splashed from a broken line into molten zinc there was no fire. Pydraul protects men working near machines like the new Kux unit, above, which operates at 800° F., 16 hours a day!



PROOF OF PYDRAUL SAFETY... In top photo, ordinary hydraulic fluid sprayed into oxyacetylene torch burns explosively. Below, Pydraul does not!

TOPS IN LUBRICATION TESTS... Timken Lubricant Test shows Pydraul has film strength of 17,500 psi . . . common water-base fluid, only 3,700 psi! In Almen Wear Test, using Pydraul, only 2 mg. of metal was lost in 20-minute run. Using petroleum oil, metal seized in one minute under the same load.

RE-USABLE, CAN'T CORRODE! Pydraul offers low make-up rate, high stability, can be re-used over and over again. And because it has a chemical base—not water—Pydraul can't corrode metal parts. For safety and savings, install Pydraul!

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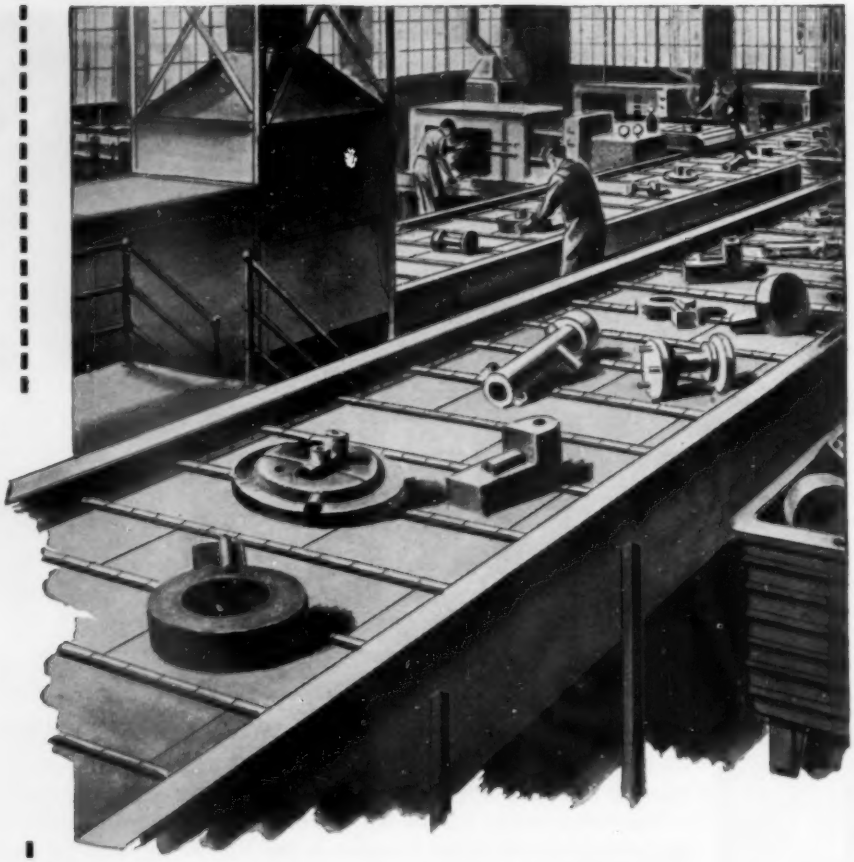
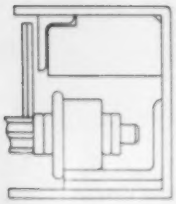
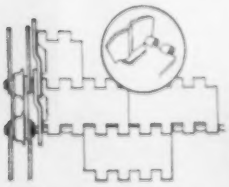
the belt with 9 lives



May-Fran hinged-steel conveyor belt . . . out performs them all in the foundry



Drawing shows construction details of "skirt" which prevents entry of foreign matter and protects side chains.

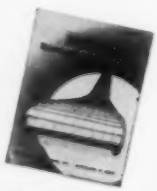


Outside links incorporate interlocking wings . . . remain positively engaged at all times.

May-Fran Belting is precision formed . . . specifically designed and developed to handle hot, heavy and the most abrasive parts. That's why it has nine lives.

Heavy gauge hinged-steel links are connected in horizontal rows by means of high-carbon steel rods. Side chains become an integral part of the locking wings which remain positively engaged at all times. Link and rod construction eliminates fall-through.

Widths furnished from 6-inches to 6-feet can meet your specifications for a steel conveyor belt of any length or carrying capacity. Either solid or perforated links are available in 2½, 4, 6, 9 and 12-inch pitch lengths. For conveyor belting that out performs, out lives them all . . . specify May-Fran Hinged-Steel Conveyor Belting.



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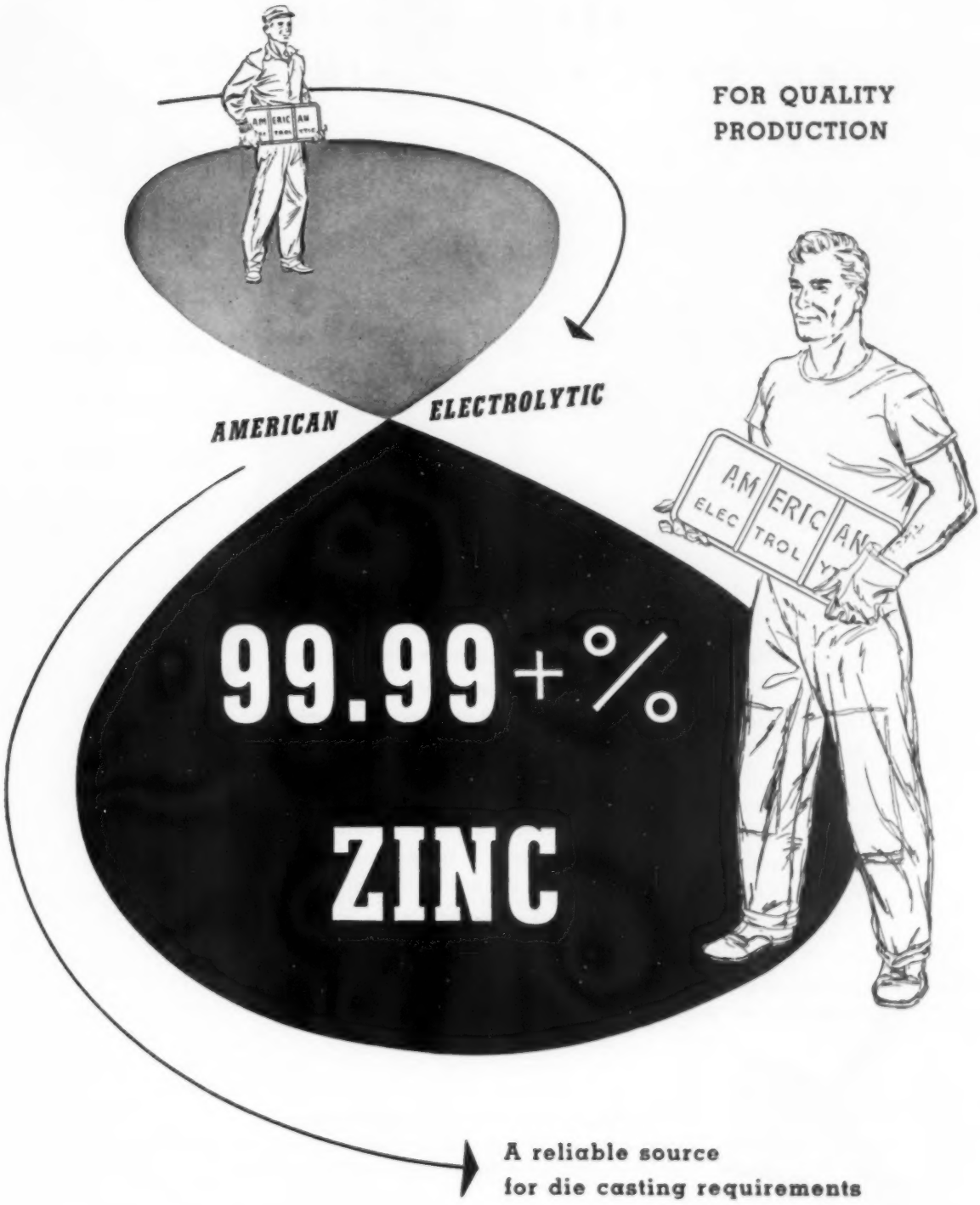
A review of recent U.S. PATENTS

HIGH TEMPERATURE ALLOY. A cobalt base alloy with high resistance to rupture under stress at temperatures of up to 1600F. The composition being substantially 45 to 58 percent cobalt, 7 to under 12 percent nickel, 17 to 22 percent chromium, 8 to 25 percent in aggregate of at least one metal from the group of tungsten and molybdenum with an upper limit of 16 percent for each element and carbon under 0.3 percent. The balance is iron.

(Patent No. 2,704,250 — High Temperature High Strength Alloys—Peter Payson—assigned to Crucible Steel Co. of America—issued March 15, 1955).

A DIE CASTING apparatus comprising a pair of die supporting plates arranged in face to face relation mounted for relative movement toward and away from each other along a longitudinal direction, a pair of guide channel bats positioned in parallel spaced apart relation between said plates and being mounted for movement relative to said plates so that said channel bars may be spaced from both of said plates when the plates are separated, said guide channel bars being provided with grooves on their adjacent inner facing edges, article forming dies mounted on the plates and projectable into the space between the channel bars. The plates being so arranged that in their closest position a space is maintained between for passage of the moldable material from the mold cavity formed by the dies and into the space formed by the grooves in the channel bars. Means supported by and mounted for movement relative to the channel bars for engaging the portions of a slug formed in the channel grooves and feeding the article and slug a fixed distance so that the article entirely clears the dies.

Continued on page 79



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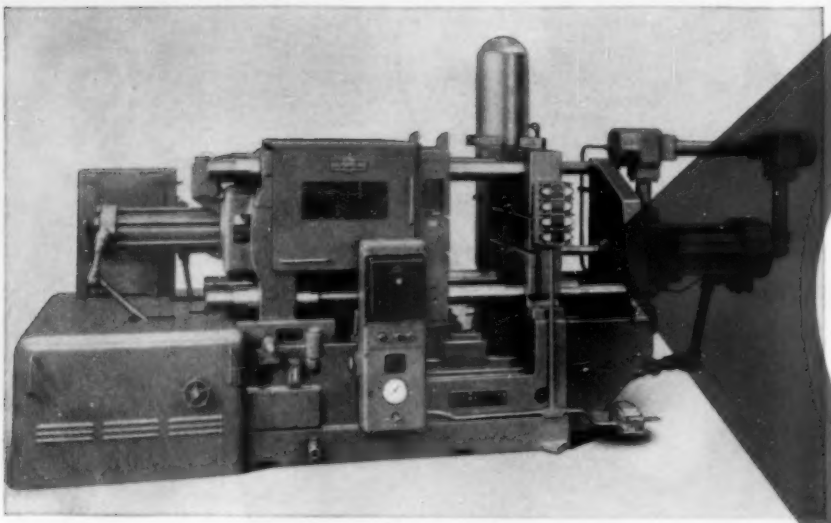

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This results in extra-dense, porosity-free castings of uniform high quality . . . assuring you of repeat orders from your customers.

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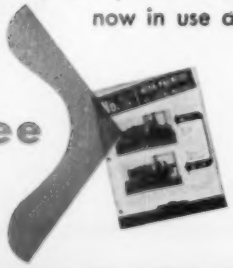
Machine	*Magnesium*	*Aluminum*
1½G	2.5 lb.	3.75 lb.
2 G	6 lb.	9 lb.

The "Hi-Speed, Hi-Pressure" Plunger unit can be applied to machines now in use as well as to new machines.



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BETWEEN THE LINES

WHY WORRY ABOUT CASTABILITY? If you are a designer or buyer of castings, you probably should know more than you do about the influence of castability on the price and properties of the pieces you specify. These are matters of interest not only to the foundryman, but should be known by the man at the drawing board. By selecting the most castable alloys that meet your physical specifications, you can save your company money and speed the delivery of castings. A detailed discussion of the desired casting properties of alloys that are investment cast begins in this issue, and will be followed in July with a study of specific alloy groups. See page 44.

FUNCTIONAL FINISH TO 6-8 MICRO-INCHES is obtained on sintered jet compressor blades by means of a sequence of abrasive belt, abrasive blast, grinding, wire brushing and plating operations. A photo report on this precision finishing cycle at Thompson Products' plant in Cleveland appears in this issue.

INSERTS GALORE. All sorts of materials are cast as inserts in die castings nowadays. This includes not only bushings, sleeves, stiffeners and the usual run-of-the-mill metal inserts, but also paper, cloth, wood and other non-metallics. One of the more interesting uses of inserts in die castings to come to our attention recently is the accurate positioning of 192 fine wires in a small zinc die casting used in a business machine. The story begins on page 55.

GET MORE FROM YOUR ABRASIVE BELTS. Coming up next month is an article that will help you get the most service from your abrasive belts for grinding die castings and other non-ferrous castings. We asked a specialist in that field to answer some questions for us to help in planning your abrasive belt operations. His answers cover such queries as: How do you get good tracking over soft contour contact wheels? What speeds are best? What types of machines are most widely used? And many others.

UNIFORM HARDNESS in investment cast 410 stainless steel can now be obtained. A recommended heat treating procedure is offered in this issue. It was developed to meet the needs of a major aircraft manufacturer.

SINGLE SOURCE? Some buyers procure their castings from a number of different jobbing foundries, other prefer to buy them all in one place. There are sound reasons for each practice. Some of the economic factors in favor of single-source buying are presented in a description of the die castings used in a blower assembly in this issue on page 53.

MACK TRUCK
Specifies Epco
INVESTMENT CASTING
for Vital Part

Bulldog Symbol of Mack Trucks Sturdiness and Dependability

"EPCO Cast lever used by Mack Diesel trucks and buses on hydraulic governor control."

INVESTMENT CASTINGS IN ANY CASTABLE ALLOY EXCEPT MAGNESIUM

Mack engineers specified an EPCO Investment Casting on the above part that was previously machined from ½ inch flat stock.

EPCO Cast in SAE 1045 steel ready for use except for tapping of ¼-20 thread, the lever was made at less cost and well within Mack's high quality standards.

EPCO Cast levers have been in constant use since 1947, and have performed with the same rugged dependability expected in a Mack Bus or Truck.

Get an EPCO quotation before machining or assembling your intricate parts.

Ask about our Vacuum Casting Process for increased quality control

Epco
ENGINEERED PRECISION CASTING CO.

FREEHOLD RD.
MATAWAN, N.J.

Circle No. 75 on the Reader Service Card

Battery of 1100 H.P. Worthington Compressors at Celanese petrochemical plant, Bishop, Texas, where CELLULUBE* 220 has given efficient service since 1952.

Celanese* CELLULUBE*s

synthetic lubricants in controlled viscosities

Celanese CELLULUBES have been developed to meet the pressing need for non-carbon-forming lubricants that are both safe and efficient.

These synthetic lubricants are phosphate esters—straight chemical compounds controlled to specification viscosities. They have excellent lubricity . . . are non-corrosive, non-reactive, non-oxidizing in air compressor service.

CELLULUBES are *non-petroleum* oils. They greatly reduce the formation of carbon deposits, a prime source of air compressor explosions and fires.

CELLULUBES have been job-tested for 3 years in actual compressor installations. Evaluate them in your own operation. Use coupon below to order samples and complete technical data.

Celanese Corporation of America
Chemical Division, Dept. 589F
180 Madison Avenue, New York 16, New York.

Celanese Corporation of America, Chemical Division, Dept. 589F
180 Madison Avenue, New York 16, N. Y.

Please send me sample and technical bulletin on Cellulube fire-resistant Synthetic Lubricants for air compressor service.

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE ____ STATE _____

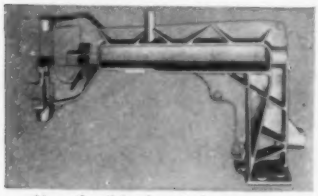
Celanese* CHEMICALS

*Reg. U.S. Pat. Off.

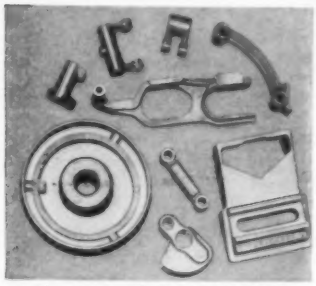
For more information circle No. 14 on the Reader Service Card

DIE CASTING REPORT

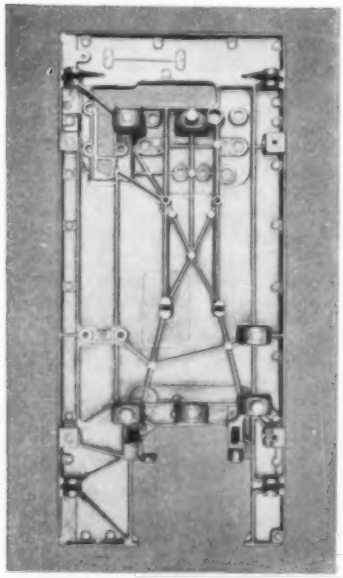
Front half, cover casting



Heavily ribbed main frame



Aluminum and zinc components



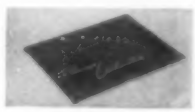
Intricate die-cast base

Die-casting helps achieve simplicity of design

New Materials and Methods plus Automotive Design Thinking . . .

Kicked off mass production of revolutionary portable sewing machine

Automotive design thinking contributed considerably to the development of a sewing machine now being produced by the New Process Gear Corp. of Syracuse, N. Y. Faced with a customer request to build a new portable, New Process engineers discarded 50 years of standard construction methods and decided to eliminate cast iron, minimize stampings, and make maximum use of aluminum and zinc die-castings. Thinking along automotive lines they designed 4 basic die-cast parts: a front and back cover (like an automobile body), a main frame and base (the chassis). Precision engineers worked closely with customer, suggesting additional ribbing and refinements to add strength and reduce weight.



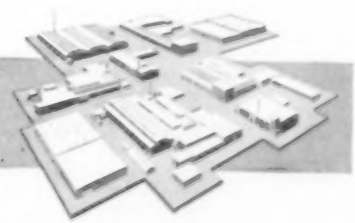
PAY-OFF:

Sewing machine has clean functional lines, weighs 50% less than competitive models. Unit has 50 less parts. Gears are eliminated. Nylon cams and a positive chain drive achieve quieter, more positive operation. Machining and assembly time and costs are held to a minimum.

Creative engineering applied to aluminum, magnesium and zinc die-cast components can help you in planning a new product or part. The Precision team of design and metallurgical engineers can show you how to reduce weight, machine and shipping costs and simplify assembly. Write for the Precision story *"Die-Castings . . . Unlimited."* Address your request to: Precision Castings Co., Inc., 241 Walnut St., Fayetteville, N. Y.

PRECISION CASTINGS CO., INC.

World's largest independent producer: aluminum, magnesium and zinc die castings



FAYETTEVILLE, N. Y. — SYRACUSE, N. Y. — CORTLAND, N. Y. — NEW YORK, N. Y.
CHICAGO, ILL. — CLEVELAND, OHIO — KALAMAZOO, MICH.

For more information circle No. 43 on the Reader Service Card

DATA OFFERED IN THIS MONTH'S ADS

to get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

1. SMALL DIE CASTING MACHINES for high production as well as limited production of small parts are described in bulletin A-10 from ABC Die Casting Machine Co.

8. LONGER LIFE piston rings and plunger segment rings for die casting machines from special alloys are described and a complete list of sizes and prices given in a brochure from Auto-Diesel Piston Ring Co.

10. POWDERED METAL presses in 50 and 100 ton capacity are completely described and much basic powder metallurgical data given in engineering reports that are available from Baldwin-Lima-Hamilton Corp.

11. TAILORED MELTING STOCK primarily for investment casting, and other casting procedures that use small melts, are described and the chemistry and metallurgy of the different alloys given in the Master-Met Bulletin of Cannon-Muskegon Corp.

12. FIRE RESISTANT hydraulic fluids are fully discussed in the booklet "Ucon Hydrolubes" that has been issued by Carbide & Carbon Chemicals Co.

15. SPECIFIC INVESTMENT materials for different types of metals to be cast and for different kinds and sizes of castings are described their specifications and prices given in data from Centrifugal Casting Supply Co.

16. CLOSE TOLERANCE castings in stainless and high alloy steels are fully discussed and the properties of the as cast alloys detailed in publications of Crucible Steel Co. of America. For the right publication get the "Crucible Publication Catalog".

22. DESIGN & PRODUCTION data specifically for engineers who specify or want to specify investment castings are contained in a new booklet that has been issued by Hitchiner Mfg. Co., Inc.

23. DIE CASTING news, new applications, new methods and information about alloys are in the Henning Messenger, published monthly by Henning Bros. & Smith, Inc.

24. TECHNICAL DATA on metal powder parts, metal powders, and a brief, but thorough explanation of the powder metallurgy process are contained in new literature that has been published by the Hoeganaes Sponge Iron Corp.

26. DIE CASTING machines that include many new and revolutionary features are described in Bulletin No. 5400, published by Hydraulic Press Mfg. Co.

29. TECHNICAL DATA on die casting machines giving capacities, locking pressures, production rates, etc. are contained in a new illustrated catalog from the Kux Machine Co.

30. NEW & IMPROVED gas fired melting furnaces for non ferrous metals are completely described in bulletin No. 320 from Lindberg Engineering Co.

31. PRESSURE-PAC metal injection, a new concept in die casting machines is clearly described and illustrated in Bulletin 23.2 from Lake Erie Engineering Corp.

32. FASTER PRODUCTION with minimum scrap can be secured from the die casting machines described in bulletin 103 from Lewis Welding & Engineering Corp.

33. DESIGNING DIE CASTINGS is the major thesis of a booklet that has been published by Litemetal Dicast, Inc.

35. HOT METAL, scrap and parts conveying systems specifically designed for metal working plants are described and illustrated in brochures published by May-Fran Engineering, Inc.

45. LOWER COST dies for the die casting industry can often be made if they are hobbed. "When and How to Hob" is an informative brochure that will help the tool engineer as well as the die caster. It is available from Newark Die Hobbing and Casting Co.

49. DIE CASTING MACHINES for both zinc and aluminum are fully described and their capacities given in literature that is available from Peco Machinery Sales, Ltd.

50. HIGH SPEED, high production die casting machines are described and the unique features discussed in a new catalog that has been issued by the Reed-Prentice Corp.

53. STAINLESS STEEL ladles for handling hot metal in the casting shop are described and the available sizes and shapes listed in specification sheets from Spincraft, Inc.

55. HIGHEST QUALITY die casting metal insures sounder, better castings. The metallurgical department of George Sall Metals Co., Inc. has a special report on machining aluminum castings from such metal.

63. PAINT SPRAY MASKS, their uses, clamping and cleaning are described in leaflets available from Conforming Matrix Corp.

65. CUT BUFFING COSTS through the use of "Liquimatic" a new and improved compound for all metal finishing. Full descriptive literature is available from Hanson-Van Winkle-Munning Co.

66. MACHINE DEBURRING is possible and highly economical according to very informative literature that has been issued by Nobur Mfg. Co.

67. FINISHING ROOM problems can be largely solved by application of one or more of the methods and materials described in booklets that are available from Oakite Products, Inc.

68. PRECISION FINISHING of metal parts is discussed in a catalog that has been issued by Roto-Finish Co. Methods, materials and equipment are all covered.

69. L.V. REPORTS, a group of laboratory proven methods for polishing and buffing all types of materials have been published by Frederic B. Stevens, Inc.

70. FROM DRAWING to finished casting or finished assembly is the service offered by Tri-State Die Casting Corp. They have a complete catalog of services, facilities, etc. available.

Continued on page 18

GRC DIE CAST TINY PARTS HAVE MADE BIG CHANGES IN DESIGNERS' THINKING

Provide big opportunities for new designs, new products, new production economies.

Amazing design flexibility, made possible through Gries' unique die casting techniques, has made significant changes in designers' thinking.

They find that GRC has developed special, exclusive techniques which turn out simple or intricate parts, completely trimmed and ready for use, in *one automatic operation.*

The resulting economies, and the design latitude the Gries' methods provide, open new horizons to designers in both product development and production economies. Frequently, manufacturing operations such as slots, square holes, flats on round surfaces are completely eliminated, and even multiple part assemblies can be produced automatically!

Parts are made to fit size, shape and tolerance specifications *precisely*, and are mass-produced in quantities of 100,000 to many millions. *Smallness* is unlimited: Maximum weight, ½ oz., maximum length, 1¾ inches.

MODERN, UP-TO-DATE GRIES PLANT OFFERS COMPLETE FACILITIES

The modern Gries plant in Westchester County, New York, provides large scale production facilities for small precision parts. It offers complete tooling and design equipment, as well as facilities for secondary operations such as tapping, drilling, assembling, reaming and special machining.

Practically all commercial finishes for zinc alloy die castings can be applied. Gries' many years of experience in finishing small die castings provides highest quality finishes at lowest cost.

GRIES OFFERS MANY OTHER PRODUCTS AND SERVICES

Gries can furnish many zinc alloy products directly from stock — including die cast industrial fasteners, and has facilities for the precision molding of tiny plastic parts. If you are interested in any of these other products and services, write direct for specific information.

GRIES OFFERS FACT-FILLED INFORMATIVE DIE CASTING BULLETIN

Gries offers a factual bulletin containing charts of approximate dimensional and weight limits, comparisons of the GRC die casting method with other methods, composition and properties of zinc alloys for die castings, as well as illustrations of many typical small parts and design engineers' guide for reference in designing products that use small parts.

WRITE, WIRE OR PHONE TODAY

for your copy of the Gries Die Casting Bulletin. Find out how Gries can help you solve your parts problems — economically and efficiently. Send prints for quotations.

GRIES STAFF OF ENGINEERS AVAILABLE FOR CONSULTATION

GRC maintains a staff of experienced engineers to aid manufacturers on all phases of design production. They will design production dies that best utilize the special machines and processes that have been developed by Gries over a period of 40 years. Gries engineers are available for consultation at any time.

WORLD'S FOREMOST PRODUCER OF SMALL DIE CASTINGS

GRIES

GRIES REPRODUCER CORP.

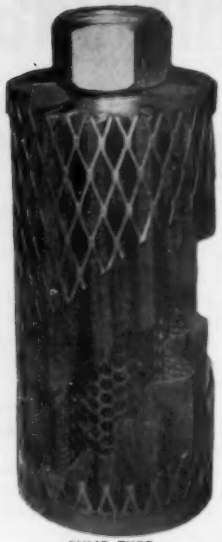
157 Beechwood Ave., New Rochelle, N. Y. NEw Rochelle 3-8600

For more information circle No. 21 on the Reader Service Card

MARVEL Synclinal FILTERS

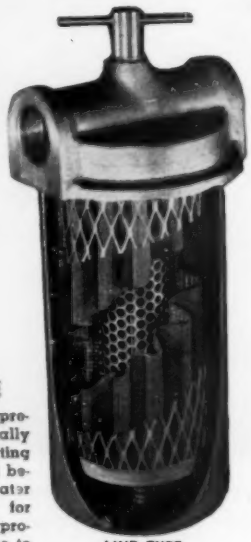
For Efficient Filtration of--

Hydraulic Oils
Fire Resistant Hydraulic Fluids
Coolants — Lubricants
Water



SUMP TYPE
(cutaway)

OVER 550
Original Equipment Manufacturers Synclinal Filters Install Marvel as Standard Equipment



LINE TYPE
(cutaway)

PROTECT EQUIPMENT
INCREASE PRODUCTION
REDUCE MAINTENANCE

Marvel Synclinal Filters installed in the sump or on the line preceding pump offer maximum protection on all hydraulically actuated and other equipment utilizing low pressure circulating oil systems. Maintenance and production costs are reduced because Marvel Synclinal Filters BALANCED design offers greater ACTIVE filtering area with sufficient storage capacity for filtered out damaging particles, thus, longer periods of productive operation are attained at minimum "down time" due to maintenance and repairs.

PRODUCTION ENGINEERS and MAINTENANCE MEN whose job it is to keep production machinery operating at peak efficiency and who have recognized the superiority of Marvel Synclinal Filters in the filtration of hydraulic oils, fire resistant hydraulic fluids, coolants, lubricants, etc. are specifying Marvel Synclinal Filters on all new equipment and standardizing with Marvel Synclinal Filters on all machines within their plants.

Another outstanding reason for their preference is the simple construction of Marvel Synclinal Filters which allows them to be easily disassembled, thoroughly cleaned and reassembled on the spot, by any workman in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of Monel mesh sizes range from coarse 30 to fine 200.

Catalogs containing complete data available on request

IMMEDIATE DELIVERY!

As in the past, Marvel continues to offer Immediate Delivery!

MARVEL ENGINEERING COMPANY

625 W. Jackson Blvd., Chicago 6, Ill.
Phones: FRANKLIN 2-3530 & FRANKLIN 2-4431

PMM-6

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated —

- ☐ Catalog No. 106—For Hydraulic Oils, Coolants and Lubricants
- ☐ Catalog No. 300—For WATER
- ☐ Data on filters for Fire-resistant hydraulic fluids.

Name .....
Title .....
Company .....
Address .....
City .....
State .....

DATA IN ADS
continued from page 16

3. DIE LUBRICANTS that provide effective dry film lubrication for die and permanent mold casting operations as well as for many other applications are described in bulletin No. 425-U10 from Acheson Colloids.

20. RUST, SCALE & SOIL are quickly and economically removed through the use of compound 134 in an electrolytic process that is thoroughly inhibited to prevent pitting. Descriptive literature is available from Enthone, Inc.

21. DESIGN ENGINEER'S reference guide to the preferred design and specification of die castings is the new bulletin from Gries Reproducer Co.

28. MORE ECONOMICAL die casting machine and hydraulic press operation is possible by controlling hydraulic fluid temperatures. Bulletin 1.1K5 from Kewanee-Ross Corp. describes the application of heat exchangers to this type of equipment.

37. NEW FEATURES of the Midwest Machine Co.'s die casting machines are fully described and illustrated in a specification bulletin that has just been issued.

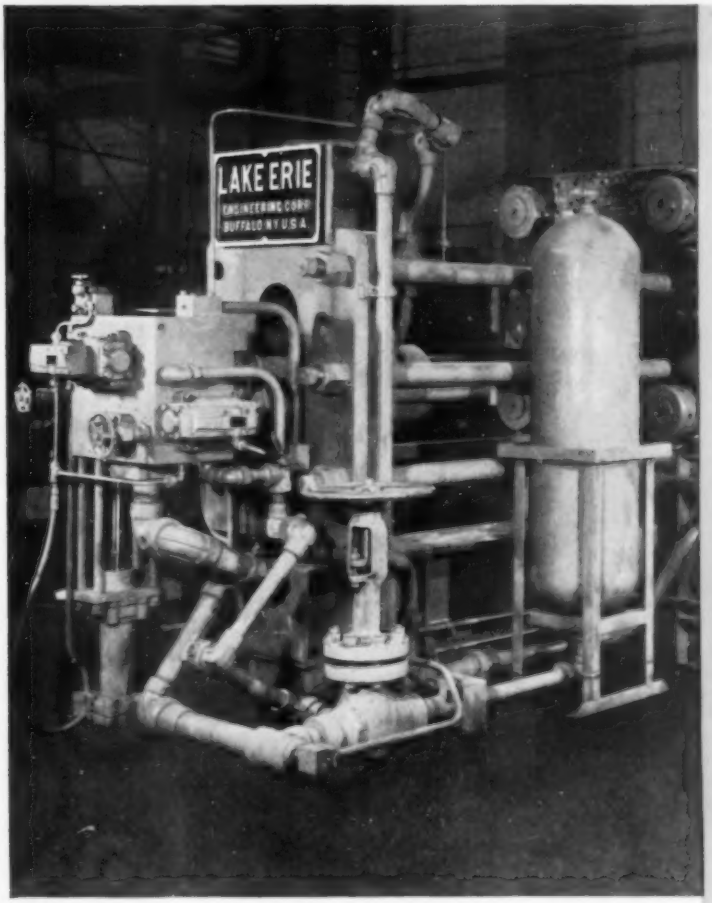
47. GUARANTEED PERFORMANCE is the feature of die casting dies made by Permanent Mold Die Co., Inc. Their new reference catalog gives all of the facts.

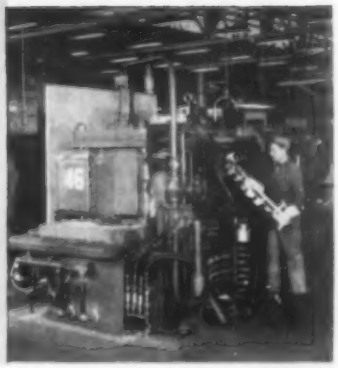
74. TWO NEW fluxes, one for zinc and one for aluminum melting are described in a bulletin from Haviland Products Co.

75. VACUUM CASTING to give sounder more intricate and smoother investment castings is the subject of new literature that has been issued by Engineered Precision Casting Co.

ALLOYS & CHEMICALS PRODUCES ZINC ALLOY

Alloys & Chemicals Mfg. Co., Inc., 4365 Bradley Road, Cleveland, Ohio, has announced that it is now in production of zinc base die casting alloys, in addition to its aluminum alloys previously manufactured. Production equipment and controls were put into operation the first of the year, and are in full-scale operation.





PRODUCE DENSER CASTINGS

with "Pressure-Pac" Injection

"Pressure-Pac" compresses the metal while it is solidifying. Denser, stronger castings result. Even surface flaws are smoothed out by the added pressure. "Pressure-Pac" is a powerful, patented pressure booster. It operates in the hydraulic circuit between the accumulator and injection cylinder. "Pressure-Pac" and the exclusive Wedge Cam Toggle are two of the reasons why so many die casters are installing Lake Erie machines.

LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

LAKE ERIE ENGINEERING CORPORATION

520 Woodward Avenue, Buffalo 17, N. Y.

LAKE ERIE ®

TYPICAL DIE CASTERS *who use Lake Erie Machines*

ALLIS-CHALMERS MFG. CO.
BENDIX AVIATION CORP.
JOHNSON MOTORS
KIEKHAEFER CORP.
DAVIDSON MFG. CO.
THE DOW CHEMICAL CO.
LUDMAN CORP.
GENERAL ELECTRIC CO.
GENERAL CONTROLS CO.
GENERAL MOTORS — TERNSTEDT DIV.
HUNTER FAN & VENTILATING CO.
BOHN ALUMINUM & BRASS CORP.
CENTRAL DIE CASTING & MFG. CO., INC.
THE ELECTRIC AUTO-LITE CO.
McCULLOCH MOTORS CORP.
OUTBOARD MARINE & MFG. CO., LTD.
RUPERT DIECASTING CO.
SUPERIOR DIE CASTING CO.
WESTINGHOUSE ELECTRIC CORP.

SEND FOR BULLETIN 23.2
(Ask about 16mm. film)

Patented Wedge Cam Toggle and "Pressure-Pac" fully described.

For more information circle No. 31 on the Reader Service Card

HERE'S AN UNUSUAL ECONOMY IN DESIGN AND PRODUCTION

2 different lamps—with 10 interchangeable parts!

CASE HISTORIES FRO
MT. VERNON FILES

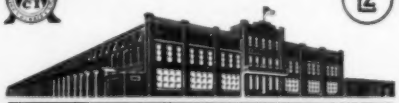
These two handsome Acme* desk lamps have quite different bases—but aside from these, they were designed so that the several other parts required for each are identical and interchangeable. Naturally, this makes for great production economies reflected in sales.

The same engineering brains that thought up this economy went directly ahead to an *added* economy—the use of die casting to make all these parts, including the two bases.

Die casting is the most economical method of producing these intricate parts—for these base clamps, articulating knuckles, and casings require thin wall sections with light weight yet with great strength.

Which is why Acme chose Mount Vernon. To make dies that will produce these varied parts at minimum cost takes experience, and extensive facilities. On both counts, Mount Vernon is the natural choice. We have a vast reservoir of experience to draw on; we have 162,000 square feet of the most modern equipment for making dies and die casting aluminum and zinc. Whether you need a single part or, like Acme, many parts, consult with us. We may show you the way to lower costs and improved products.

*Manufactured by Acme Light Products Co., Congers, N.Y.



MT. VERNON
DIE CASTING CORP.
STAMFORD, CONNECTICUT

For more information circle No. 40 on the Reader Service Card

CASTING ABOUT

CAST BERYLLIUM COPPER DIES for forging large steel, aluminum and magnesium aircraft parts may soon be a production reality. North American Aviation and Wyman-Gordon have been pushing an experimental forging die program which may cut delivery time on tooling and slash die costs by as much as 75 percent, according to The Beryllium Corp. Four design and metallurgical advancements account for current optimism over success of the program: 1) improved properties for long die life; 2) improved die surface to minimize final machining; 3) improved frictional properties of the casting alloy to virtually eliminate galling; and 4) application of a special beryllium copper alloy for forging titanium which must run at higher temperatures.

FROM TEN CENTS, the cost of a radio chassis part has been reduced to seven cents by a redesign from an assembly of four stampings to a single zinc die casting. Precision Castings Co. who produce the part in their Chicago plant, point out that this 3-cent saving, multiplied by a half million sets per year, represents the sizeable sum of $15,000. Used to hold three coils in an automobile radio, the part was once made up of a crimped assembly of steel strip and three drawn sheet metal tubes. In addition to the costly assembling operation, the part had to be plated to prevent corrosion. Now it comes from the die casting die as a complete unit.

TO HELP FOUNDRYMEN overcome difficulties in fabrication and casting of two important aluminum alloys, the Office of Technical Services, U. S. Department of Commerce, Washington 25, has released two volumes detailing processes successfully tested in government-sponsored research. These alloys are: 1) a cold-worked, magnetic, high aluminum-iron alloy known as 16-Alfenol, and 2) a 10 percent magnesium alloy, important for its high strength, ductility, corrosion resistance and low density. The 27-page book on Alfenol is available from OTS for 75 cents, while foundry manual on the 10 percent Mg alloy sells for $3.25.

HARD COATING for the die cast alloys, as well as steel and other metals, is obtained by a novel process developed at Armour Research Foundation, Illinois Tech. It feeds powdered ceramic materials such as aluminum oxide and zirconium oxide through a simple flame gun to deposit a very hard, sintered layer of refractory, chemically inert material on the surface being processed. The coating is said to be harder than tool steel and unusually adherent in deposits up to 10 mils. Suggested uses include: protection against abrasion or erosion in pump impellers and housings; mold coating for permanent mold casting; linings for flame ducts, burner equipment, foundry equipment; thermal protection of engine parts; decorative surface coating.

WITH ABOUT 7 PERCENT of the world's population, the United States consumes about 40 percent of the world's primary zinc. John D. Sullivan of Battelle gave the American Zinc Institute a statistical study of consumption of metals and other commodities in relationship to "living standards" recently. Zinc die castings figure importantly in a large number of industrial products that go to make up our living standard.

(Continued on page 23)

NEW...

- New low prices
- New improved design
- New stock sizes

in

Spincraft ladles

Available with or without handles — in stainless steel and mild steel.

If you pour non-ferrous alloys — now, more than ever, Spincraft ladles belong in your plant. You can select from 23 practical sizes (from ¼ lb. to 30 lb. capacity in molten aluminum) — in top quality stainless steel — for *less* than you've ever paid before.

And . . . experience shows new Spincraft ladles actually cost less to use. Here's why —

Reinforced cup bottom and pouring edge have been spun to a heavier gauge than the weight-saving side walls. This means you get easier handling, better heat transfer, and reduced "burnouts" for longer ladle life. Handles are "whack-proof". Cup surfaces are specially finished to hold any type of ladle coating longer.

Hand any operator a new Spincraft ladle — and the next day try to take it away from him! You'll see how the practical conical shape, the built-in overall balance, minimizes spillage as he "swings" from crucible to machine or mold. Notice how every motion takes less effort. And there's a reason: — for example — a Spincraft stainless steel ladle in the 65 cu. in. size weighs from 2 to 11 pounds *less* than conventional cast or malleable iron, forged or pressed steel ladles.

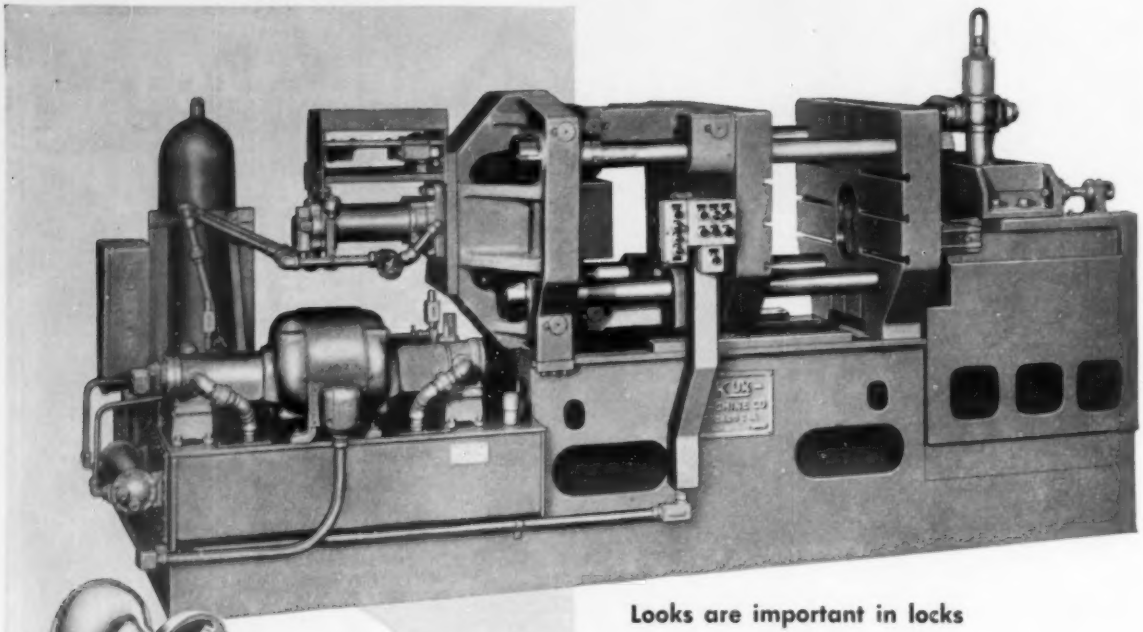
Order Spincraft ladles for your plant. Cut operator fatigue—pour more metal, for greater efficiency and profit.

Write today for new low prices. Special sizes, gauges, handles and materials will be quoted on request.

Spincraft
SKILL WILL DO IT
INCORPORATED

4131 W. State St., Milwaukee 8, Wis.

circle No. 53 on the Reader Service Card



Looks are important in locks

SO . . . KWIKSET CHOSE

KUX

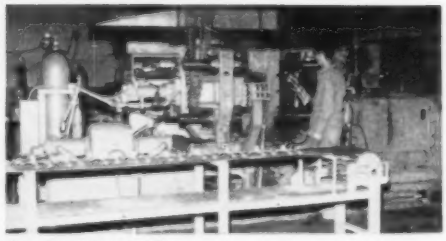
DIE CASTING MACHINES

to get hardware finish quality

Locks must have eye appeal to sell . . . they must be economically priced . . . easy to install . . . and offer long trouble-free service. Kwikset Locks, Inc., Anaheim, Calif., has achieved all these things which accounts for the more than 25,000,000 of its "400 line" of locksets now in *unconditionally guaranteed* service.

KUX die casting machines have played an important role in this remarkable record. Many of the individual parts that make up the three easy-to-install precision-matched components of a "400" lockset are die cast. KUX machines are used because Kwikset knows a hardware finish quality is obtained on every gate cast. A dense hardware finish quality on a close tolerance casting reduces costs throughout the manufacturing and assembly processes and puts Kwikset in a fine competitive position.

KUX produces a full range of modern die casting machines that require only the touch of an electric button to put them automatically through a complete casting cycle at high production speeds. KUX engineers will be glad to show you how die casting machines can serve you. Or, write for an illustrated catalog.



The New MODEL BH-30

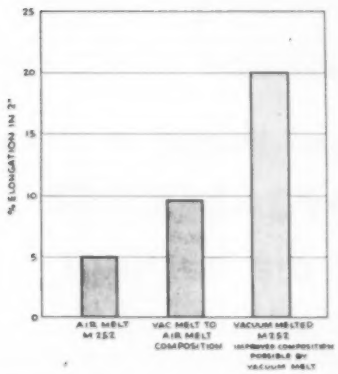
This new, more powerful, higher speed model shown above, is a hydraulically operated gooseneck plunger type of machine for production of zinc, lead or tin die castings. It is one of the many KUX machines in operation at the Kwikset plant.

KUX MACHINE CO.
6725 NORTH RIDGE AVENUE
CHICAGO 26, ILLINOIS

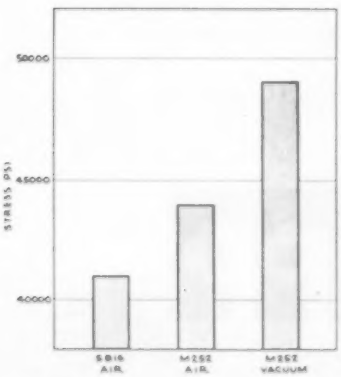
For more information circle No. 29 on the Reader Service Card

CASTING ABOUT
continued from page 21

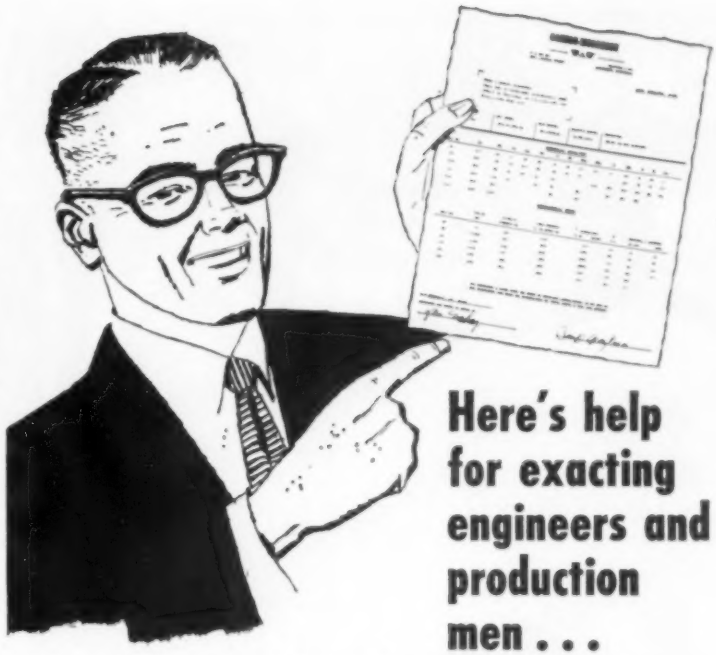
HOW DO VACUUM MELTED METALS stack up for the user? Since present melting costs are high (roughly from $1 to $3 per pound) what are the incentives? Carboloy Department of G. E., one of several companies now producing such products, says vacuum-melted metals pay off in: 1) yield, 2) better workability, 3) increased ductility of the end product; 4) improved fatigue strength. Reasons for vacuum melting include increased cleanliness, closer composition control, and creation, of new alloys. One company has reported increase in fatigue strength of 52100 steel from 85,000 psi to 125,000 psi by change from air melt to vacuum melt. Improvements in properties of M-252, a nickel-base jet engine alloy are also illustrated in accompanying graphs.



TENSILE DUCTILITY IMPROVEMENT (M252) 1350 F.



FATIGUE STRENGTH IMPROVEMENT (M252) 1500 F and 10^5 cycles.



Here's help for exacting engineers and production men . . .

who must be absolutely right about metal analysis

WITH each MasterMet alloy you buy, Cannon-Muskegon gives you a certified, notarized analysis . . . black-on-white proof that MasterMet alloys are produced exactly to your specifications. This assures close predictable control of physical and chemical characteristics for any end-use. You can be confident that the results you plan — the performance you call for will be delivered in parts made with MasterMet alloys.

You can choose from a wide range of high alloys including cobalt-base and nickel-base alloys, chromium and chromium nickel stainless steels. Also included are such special alloys as Monel*, Inconel*, Invar, Ni-Resist*. Order these types or your custom specifications from Cannon-Muskegon.

*Trademark — International Nickel Co.

FOR REMELT OR PROCESSING

MasterMet alloys are available in shot, ingots and cast billets, bars and special shapes. Often the more common low alloy and 300 and 400 Series stainless steels can be shipped from stock. Remember . . . whatever your needs, Cannon-Muskegon can provide metallurgical engineering assistance in recommending the proper alloy — as well as the proper handling — to assure the best possible casting. Write for bulletin!

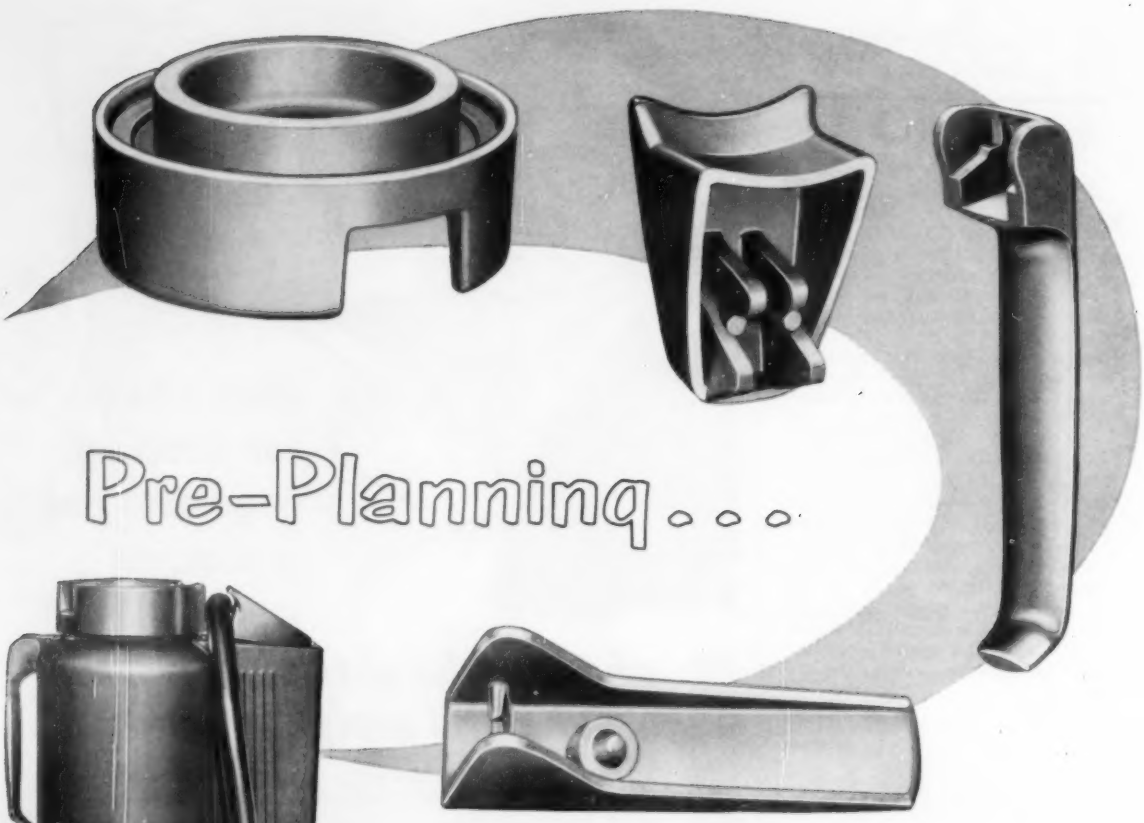
Cannon-Muskegon
CORPORATION
2871 LINCOLN STREET • MUSKEGON, MICHIGAN

ARE YOU ON OUR MAILING LIST

to receive inventory data on "in-stock" alloys? You'll find a surprising number of alloys listed ready for immediate delivery. Write today!

MASTERMET
CERTIFIED ALLOYS FOR INDUSTRY

For more information circle No. 11 on the Reader Service Card



Pre-Planninq . . .

Illustrating the Ansul Chemical Company's 10-pound dry chemical fire extinguisher. The group of four die castings was developed with the close cooperation of Ansul Engineers and Madison-Kipp Die Designers.

an important design phase with **MADISON-KIPP** *zinc and aluminum die castings*

In almost every product design cycle there is a pre-planning stage when major changes can be made with comparative ease. It is then that it is valuable to have in mind such things as parting line possibilities, metal entrance, machining control points, draft angles, etc.

Our customers of long standing usually send us their rough layouts for review because this pre-planning has proved to be important in advancing time schedules and in establishing economies of manufacture.

Please clip this ad as a reminder to contact us when you have die casting requirements.

kipp

MADISON-KIPP CORPORATION
213 WAUBESA STREET • MADISON 10, WIS., U.S.A.

● Skilled in Die Casting Mechanics ● Experienced in Lubrication Engineering ● Originators of Really High Speed Air Tools

For more information circle No. 35 on the Reader Service Card

POWDER METALLURGY NEWS

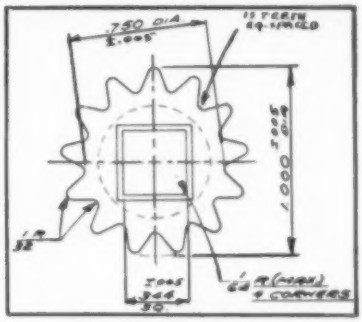
An informative service by HOEGANAES SPONGE IRON CORPORATION, manufacturer of *HOEGANAES SPONGE IRON POWDERS*

RECORD TOOL-UP TIME REDUCED COSTS

A sewing machine manufacturer required detailed, complicated stitch cam follower arms *in a hurry*. A stamping operation involved pressing, cleaning, plating and assembly. And costs were high.

Production by powder metallurgy was the time-saving, cost-saving solution. Delivery was made in record time. Costly, stamping operation was eliminated. No scrap. Parts met specifications for strength, tolerances, contour uniformity and interchangeability. Hoeganaes Sponge Iron Powders always help to solve problems like this.

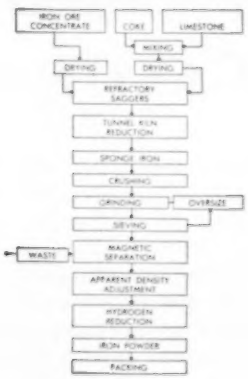
Farm Machine Manufacturer Benefits by Close Fit Units



A famous farm machinery manufacturer found that cost savings were not the only advantage of producing metal parts by powder metallurgy.

Other tangible achievements included *closer fitting mating units. Reduced noise* in operation was another advantage and resulted in smoother, more quiet operation. This finished machine part is enduringly anti-corrosive and *self-lubricating* for a long life.

Iron Ore to Iron Powder



This is the reduction process employed by Hoeganaes Sponge Iron Corp. in producing iron powder. Dry raw materials are charged into refractory saggers, which are stationary on tunnel kiln cars. The main reduction takes place in the world's largest tunnel kiln with fully automatic temperature control.

Main steps in treating the resulting sponge iron cakes into iron powder are crushing, grinding, sieving and the all important magnetic separation process to assure purity. The powder is then given a final heat treatment in annealing furnaces provided with hydrogen as protective atmosphere.

Tunnel Kiln 570 Feet Long

Typical of the modern production equipment in the Hoeganaes plants is this 570 feet tunnel kiln.

More than 95% of the oxygen in the ore is removed in a primary stage. Heat is provided from 72 gas-fired burners, arranged in four groups, with automatic temperature control for each group.

Conventional Machining Operations Eliminated

The powder metallurgy process permits partial or complete elimination of costly machining and finishing operations.

For example: a standard gear made by powder metallurgy process by-passes these conventional machining operations. Boring, chamfering, facing, gear cutting, keywaying, drilling and turning.

The result: amazing cost economies.

NEW, FREE

Informative Literature on Powder Metallurgy

Describes advantages and production short-cuts possible, when metal parts are produced by powder metallurgy.

Hoeganaes Sponge Iron Corporation,
Riverton, New Jersey

Please send me your free literature on Powder Metallurgy.

Name .....

Company .....

City Zone State

HOEGANAES
SPONGE IRON POWDERS

Superior grade metal parts from superior grade iron powder.

HOEGANAES
SPONGE IRON CORP.
543 Fifth Avenue, New York 17, N. Y.
Plant: Riverton, New Jersey
Distributed by EKSTRAND & THOLAND, INC.
441 Lexington Ave., New York 17, N. Y.

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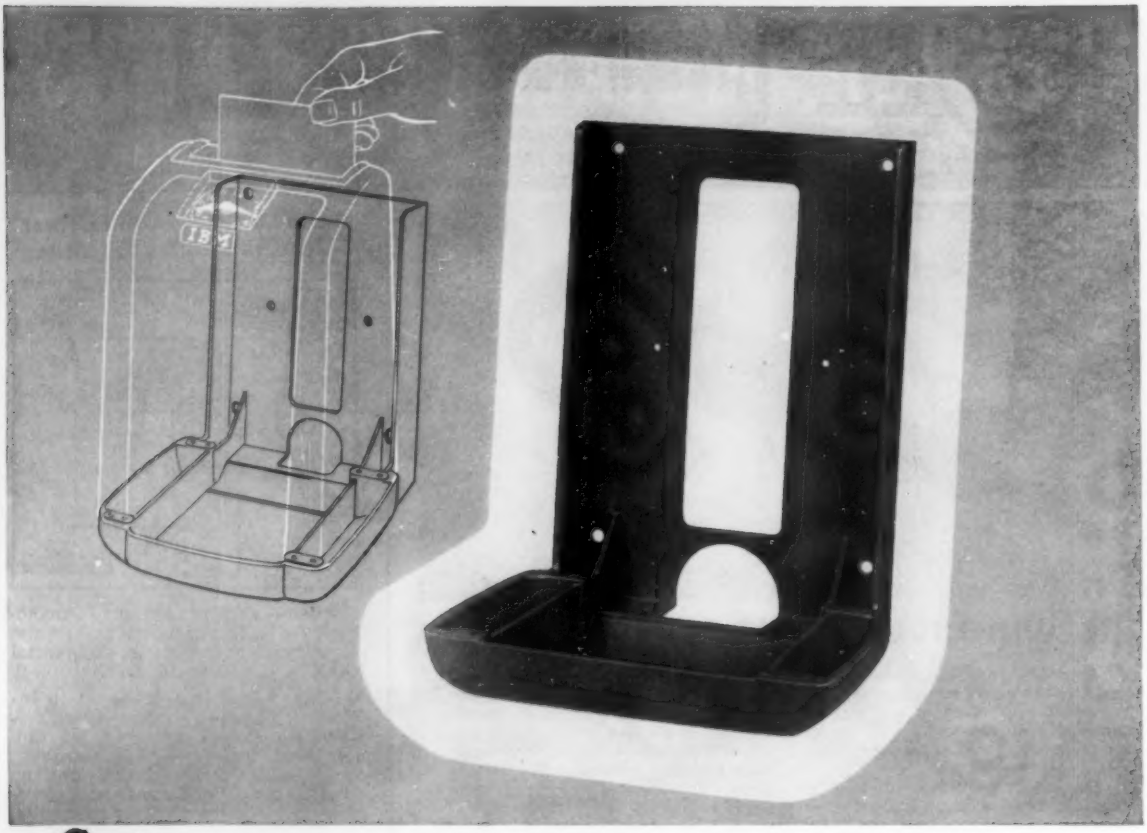


TIME MARCHES ON *automatically . . . supported by* PARKER DIE CASTINGS

PARKER SALES ENGINEERS

CHICAGO 49, Ill.
Ollie J. Berger Company • 2059 East 72 Street

CINCINNATI, Ohio
William H. Broxterman • 2174 Buck Street

DETROIT 35, Mich.
Hodgson-Geisler Co. • 18917 James Couzens

GIRARD, Penna.
Daniel F. Marsh • 35 Chestnut Street

KIRKWOOD 22, Mo.
Edward F. Higgins, Jr. • 102 West Adams Street

WILTON, Conn.
Girard L. Palmer • Belden Hill Road

SYRACUSE, N. Y.
J. C. Palmer • 712 State Tower Bldg.

BELLEFONTE, Penna.
Warren G. Olson • 420 East Linn Street

IBM's fully-automatic, electric time recorder is a far cry from the old-fashioned time clock. This modern engineering development handles with ease and sureness any kind of work schedule, no matter how complex. To produce the wall mounting bracket shown above, IBM and Parker together worked out the design of the part. The result: a die casting that meets every specification at lower total cost.

This close co-operation from blue print to finished product typifies the complete engineering—as well as manufacturing—service offered by Parker. No matter how complex your die casting problem, Parker will be glad to help you find the answer. Just call the nearest Parker sales engineer listed at the left or write the factory direct.

Parker White Metal Company • 2153 McKinley Ave., Erie, Pa.

PARKER **ALUMINUM and ZINC *die castings***

For more information circle No. 46 on the Reader Service Card

WHY ZINC RATES FIRST IN DIE CASTING • NUMBER 3 OF A SERIES

castability — as utilized by PHILCO

These components of the 1955 Philco Roastmeter electric range reveal the wide design latitude possible with ZINC die castings. No other metal or method of production offers product engineers equal freedom of expression with respect to shape, detail and finish.

Consider, for example, two of the castings—the clock face and frame. Not only are these ZINC die castings extremely complex in shape, but the lettering and numerals (both recessed and raised) are sharply defined and the casting surfaces are ready for either plated or painted coatings.

While these attributes of ZINC die castings govern the appearance of the finished product, they also have a decided influence on production costs. The complexity of shape and clean-cut design details minimize the need for secondary operations. And the smooth as-cast surfaces of these ZINC die castings easily take and hold any commercial finish.

Other examples of product engineering with ZINC die castings will be covered in future advertisements in this magazine. Send for our brochure and contact any commercial die caster for the answers to your particular production problems.

The New Jersey Zinc Company 160 Front St., New York 38, N. Y.

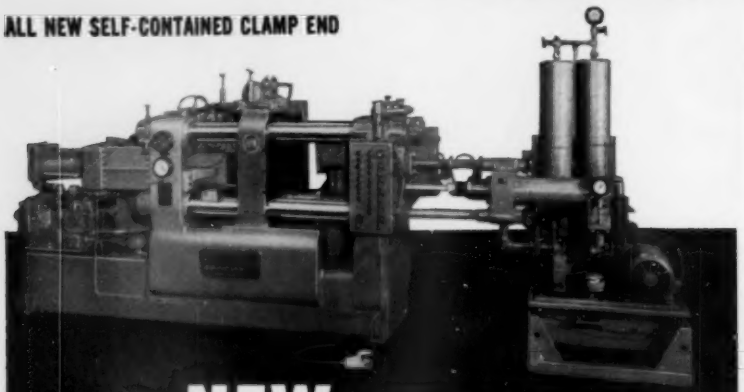
ZINC
FOR DIE CASTING ALLOYS

The Research was done, the Alloys were developed, and most Die Castings are based on

HORSE HEAD SPECIAL (99.99 + % Uniform Quality) ZINC

ALL NEW SELF-CONTAINED INJECTION END

ALL NEW SELF-CONTAINED CLAMP END



A NEW APPROACH TO DIE CASTING

NEW H-P-M DIE CASTING MACHINE OFFERS MORE THAN JUST NEW MACHINE DESIGN

The new H-P-M die casting machines are being hailed as the most important advancement in die casting in fifteen years, and rightly so . . . more than forty new and improved features! These features result in minimum mold flash . . . faster die set-up . . . greater versatility in die usage and casting design . . . reduced maintenance . . . maximum safety and performance. The new self-contained Link-Wedge mold clamp is the best. There's plenty of "beef" in these new models. They are available in a complete range of sizes ...cold chamber or gooseneck types.

Write for Bulletin 5400 which describes these new units in detail.

HPM

THE HYDRAULIC PRESS MFG. COMPANY
1094 Marion Road
Mount Gilead, Ohio, U. S. A.

For more information circle No. 26 on the Reader Service Card

Milton T. Schimmel has been appointed general manager and Gerald D. Minnick plant superintendent of *Conforming Matrix Corp.*

John Bermingham has been appointed the Western sales manager for *E. F. Houghton & Co.*

Harold E. Brown has been appointed general manager of the new *Dwight Lloyd Div. of McDowell Co., Inc.*

Dr. Augustus B. Kinzel has been elected vice-president-research of *Union Carbide & Carbon Corp.*, succeeding **Dr. George O. Curme, Jr.** Dr. Curme, who is retiring as vice-president of the corporation, will continue as a director.

Robert C. Overstreet has been elected president of *Tinnerman Products, Inc.*

Aurora Metal Co. has announced the appointment of **C. E. Overly** as their sales engineering representative to cover the Youngstown, Ohio-Pittsburgh, Pennsylvania area.

G. J. Andres and **H. C. Colburn** have been appointed to the sales staff of *Empire Steel Castings, Inc.*

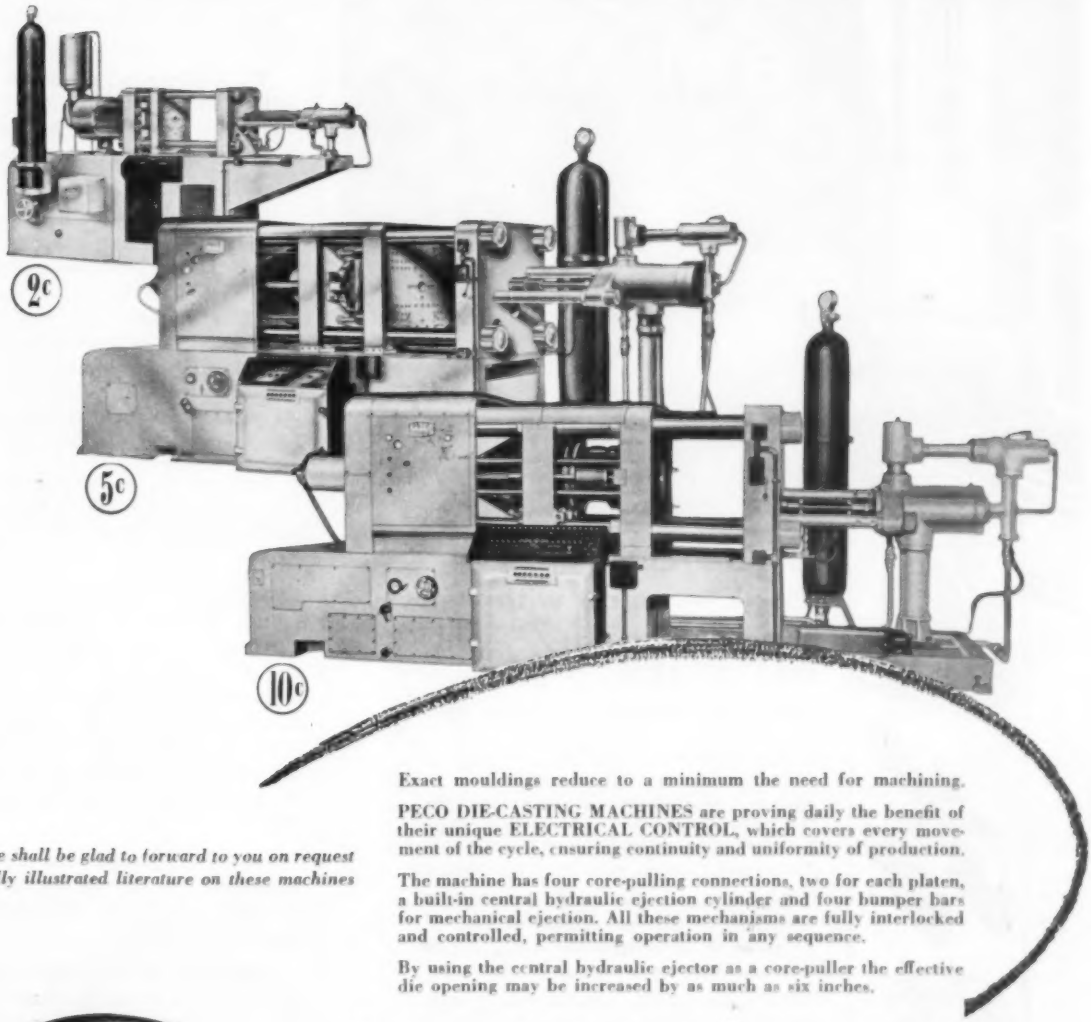
Three appointments have been announced by the *F. J. Stokes Machine Co., Inc.*; **J. Gordon Seiter** as manager of the new High Vacuum Div., **Kendrick C. Taylor** as manager of vacuum furnace sales and **G. Jewett Crites** as manager of the Vacuum Processing Division.

W. W. Rinehart has been appointed assistant controller in charge of the *Crucible Steel Co. of America's* mill accounting and **F. W. Bloom** works controller.

Donald R. Fegley has been appointed chief engineer of *Reed-Prentice Corp.*

Continued on page 30

Thousands of Different Castings all with the same 'PECO' PRECISION



Exact mouldings reduce to a minimum the need for machining.

PECO DIE-CASTING MACHINES are proving daily the benefit of their unique ELECTRICAL CONTROL, which covers every movement of the cycle, ensuring continuity and uniformity of production.

The machine has four core-pulling connections, two for each platen, a built-in central hydraulic ejection cylinder and four bumper bars for mechanical ejection. All these mechanisms are fully interlocked and controlled, permitting operation in any sequence.

By using the central hydraulic ejector as a core-puller the effective die opening may be increased by as much as six inches.

We shall be glad to forward to you on request fully illustrated literature on these machines

PECO PRODUCTS

The company has developed an important new range of HOT CHAMBER die-casting machines, which will be of considerable interest to manufacturers.

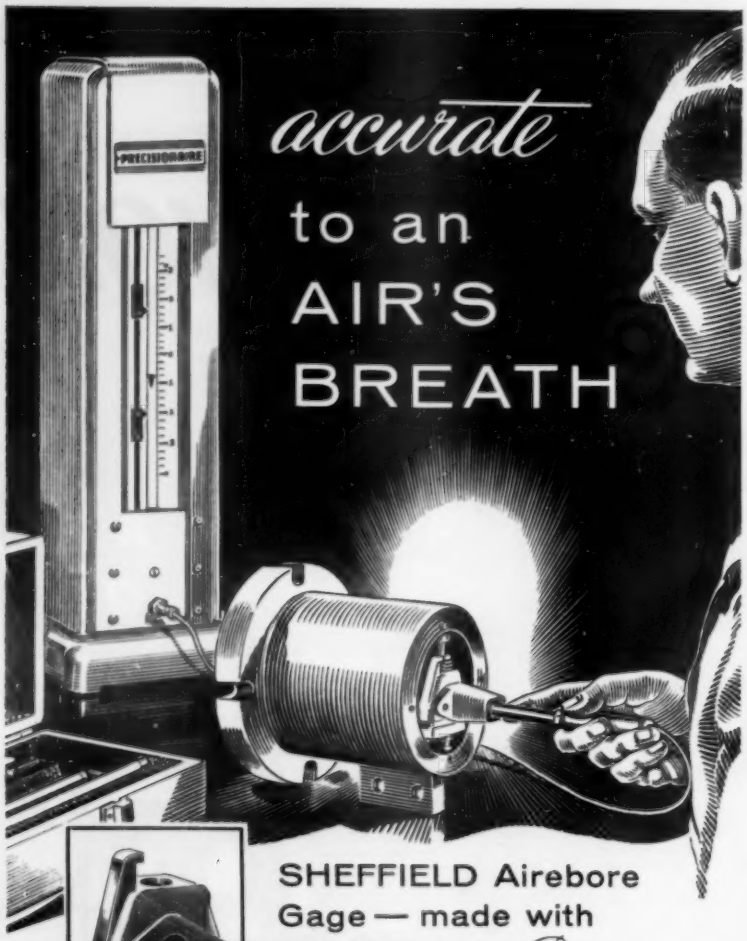
PECO MACHINERY SALES (Westminster) LTD.

28 VICTORIA STREET, LONDON, S.W.I. **Telephone: ABBey 1793/4/5**

Telegrams: "PROFECTUS," SOWEST, LONDON Cables: PROFECTUS, LONDON

Works: THE PROJECTILE AND ENGINEERING COMPANY LIMITED

For more information circle No. 49 on the Reader Service Card



SHEFFIELD Airebore Gage — made with

HITCHINER *Precision* INVESTMENT CASTINGS

The extreme accuracy of the Sheffield Adjustable Airebore Gage requires highest quality in its parts or components. Yet, they have to be produced in volume lots at low cost. Hitchiner Precision Investment Castings meet these requirements.

Whenever the need for design and production economies in the manufacture of *your* precision metal components arises, you too can turn with confidence to Hitchiner.

Write today for the valuable free booklet containing design and production data on Hitchiner Precision Investment Castings — or write for the name of the nearest Hitchiner representative who can give you full details.

HITCHINER Manufacturing Company, Inc.

Precision Investment Castings

MILFORD 7, NEW HAMPSHIRE

REPRESENTATIVES IN PRINCIPAL CITIES

For more information circle No. 22 on the Reader Service Card

NAMES IN THE NEWS

continued from page 28

Hopper & Son have been appointed exclusive sales representatives for *Alloy Precision Castings Co.* in the western Pennsylvania, northern West Virginia and southeastern Ohio territory.

W. A. Roberts, president of *Allis-Chalmers Mfg. Co.*, died suddenly April 12 following a heart attack. Mr. Roberts was 57 years old.

H. C. Chobanian has been appointed assistant purchasing agent, tractor products and **K. H. Hoisington** buyer of electrical equipment and supplies for the *Allis-Chalmers Mfg. Co.* Mr. Hoisington succeeds **W. J. Fox,** who retired April 30, after 46 years with Allis-Chalmers purchasing department.

Edward W. Sloan, Jr. has been elected to the board of directors of *Cowles Chemical Co.*

Arthur H. Sisson has been named manager of advance engineering of the *General Electric Co.'s* Small Turbine and Supercharger Department. Also announced is the appointment of **Richard A. Baker** to the position of engineering administrator to succeed Mr. Sisson.

Lars E. Ekholm has been appointed manager of the sales division of *Climax Molybdenum Co.*

Arthur J. Buckley has been promoted to sales manager, from his former position of assistant sales manager of *Pangborn Corp.*

R. Worth Vaughan has been elected executive vice-president and treasurer of the *American Smelting & Refining Co.*

Vincent P. Reinfeld has been elected president of *Pyrosil, Inc.*

Continued on page 32

FOR PRECISION
DIE-CASTING . . .
THE IMPROVED

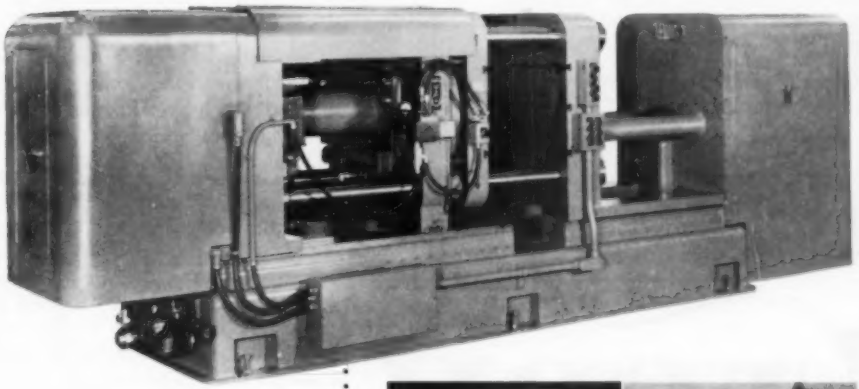
LEWIS 650-B

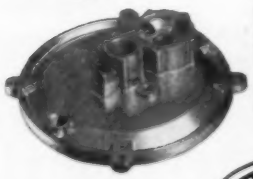
GIVES YOU FASTER
PRODUCTION . . .
MINIMUM SCRAP . . .
GREATER PROFIT

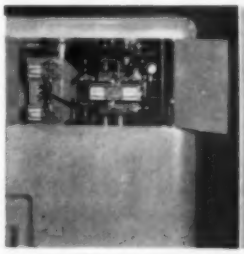
New and improved controls . . . a re-designed injection system . . . the exclusive "HYDRA-LOCK" clamp . . . and other outstanding features make this LEWIS die-forge casting machine tops in its trade.

Versatile Model 650-B produces accurate pressure-tight light-metal castings with minimum scrap. All operations, except actual pouring, are either automatic or pushbutton controlled. Maximum safety is assured by the 650-ton clamping pressure and positive locking action of the "HYDRA-LOCK" clamp.

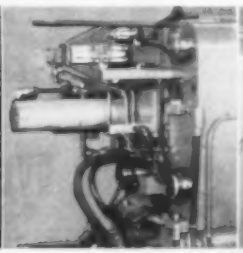
With eight years of research and pilot tests behind it, the LEWIS 650-B has been further refined . . . through "perfectionist" engineering and actual production operations . . . until it is the most advanced design available to the die-casting industry today.



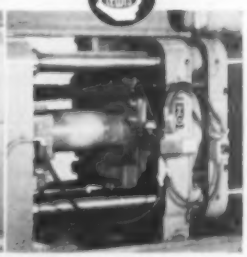




Variable two-stage injection system develops pressures up to 100,000 pounds to assure dense flawless castings. Access doors in detachable hood permit rapid adjustment.



All valves and cylinders for moving platen, clamp mechanism and sliding-block locking device are mounted in one location for fast, easy adjustment and maintenance.



"HYDRA-LOCK", a new clamp principle exclusive in LEWIS machines, utilizes a large-diameter short-stroke hydraulic cylinder to develop final closing and locking pressures up to 650 tons.

Write today for Bulletin 103 for complete details.

LEWIS

THE LEWIS WELDING & ENGINEERING CORPORATION
63 Interstate Street • Bedford, Ohio

6126-LW

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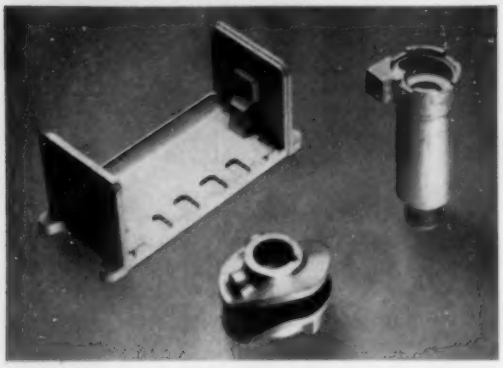
For more information circle No. 60 on the Reader Service Card



These parts were cast by Z & H Mfg. Corp. by the "Lost Wax Process" thereby eliminating costly machining operations.

Scale ½" — 1 ⅛"

SAVE MONEY!

Use our exclusive ***Precision Investment Castings.*** They are cast centrifugally, with all models and molds made by Z & H specializing in non-ferrous metals. And you get sample delivery approximately 3 weeks from day we receive order.

Prompt quotations on blueprints. Send yours now. Or write us for information on your problem pieces.

Z+H

Z & H MFG. CORP.

31 Welcher Avenue • Peekskill, New York

STROH

FOR OVER 50 YEARS

PRODUCERS OF FINEST ZINC DIE CASTINGS

Old in years but modern in production—STROH facilities for zinc die casting combine the experience of yesterday with the vision of tomorrow.

STROH'S superiority has won and held customers since the turn of the century.

Inquiries Invited!

STROH DIE MOULDED CASTING CO.

525 East Michigan St., Milwaukee 2, Wisconsin

For more information circle No. 54 on the Reader Service Card

NAMES IN THE NEWS
continued from page 30

Robert Fulton

Plamondon Magnetics Co. has announced the appointment of **Robert Fulton** eastern sales manager.

Four appointments have been announced by *Lake Erie Engineering Corp.* **E. M. Detwiler** is now manager of the corporation; **William H. Bennett,** sales manager; **Robert J. Fuller,** Assistant Treasurer; and **Robert W. Gerhardt** sales project engineer for Lake Erie's line of die casting machines.

The Board of Directors of *The Crucible Steel Co. of America* have appointed **William H. Knoell** aissistant secretary.

James C. Black has been appointed general manager of the *Reduction Div. of Reynolds Metals Co.*

Norman L. Deuble has been appointed manager of the newly created *Metallurgical Development Division of Climax Molybdenum Co.*

John C. Cotner has resigned as president and general manager of *The Hydraulic Press Mfg. Co.*

Dr. Arthur G. Metcalfe has been promoted to senior metallurgist, highest professional position at *Armour Research Foundation of Illinois Institute of Technology.*

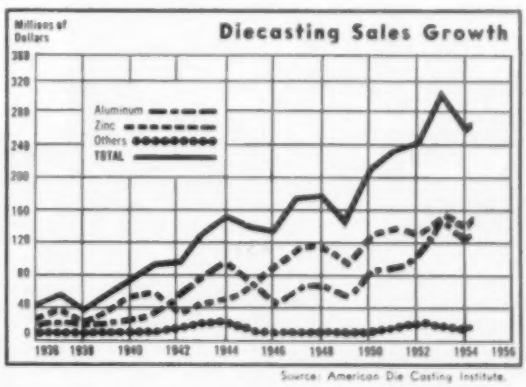
700,000

Zn Die Cast per day...

how else would you make them?

THIS ACCOMPLISHMENT IS TYPICAL of a process that can mass-produce – direct from the raw material – precise, complex-shaped close tolerance units economically. In the fast-moving automotive industry, designing with die castings ensures the high-speed and economical production of many components. This year, for example, the industry needs 76 million door and window handles. These handles are being zinc die cast at the rate of 700,000 per day – how else would you do it?

On the 1955 cars the front end assemblies alone of 16 different models contain from 22 to 40 pounds of zinc die cast parts each. The excellent physical properties of zinc are also increasingly utilized for a great variety of functional automotive parts. Because die casting actually is the "shortest distance between raw material to finished product," it is the outstanding production technique for innumerable components of home appliances, instruments, hand tools, business machines, electrical equipment and many other products basic to the American economy. In fact, the die casting industry consumes over one-third of the total zinc used annually in this country.



Source: American Die Casting Institute.

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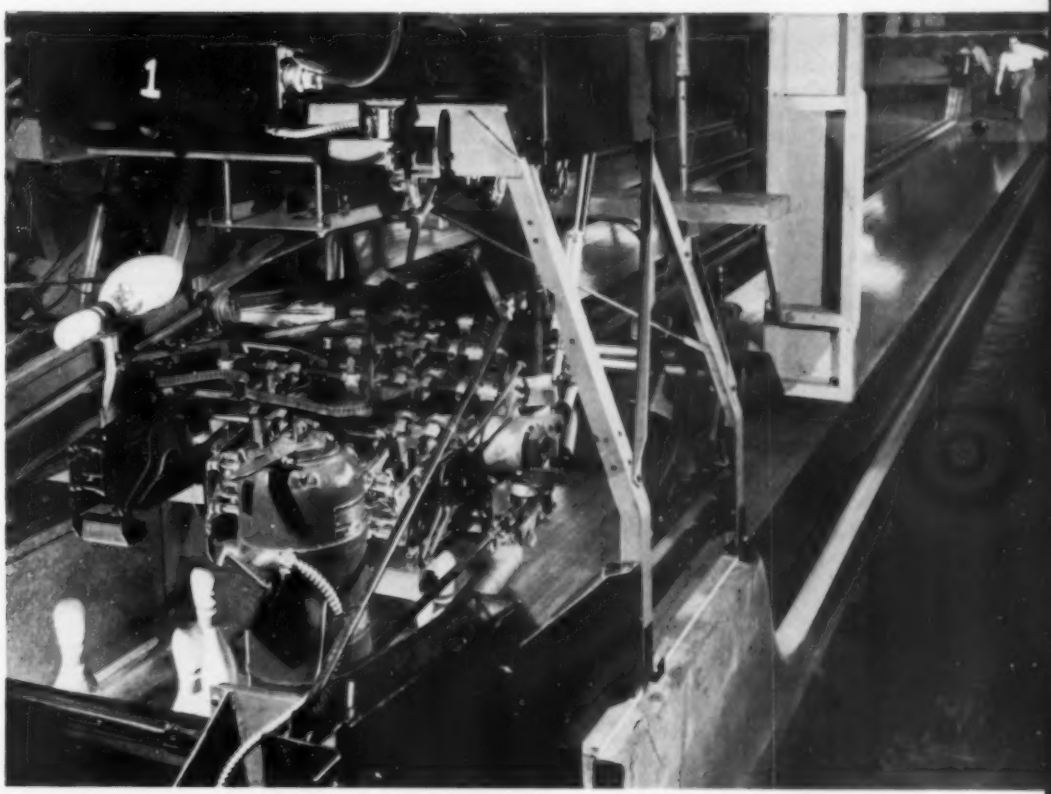


80 PMM Parts Implement The

Design Features of AMF's Pinspotter

INDUSTRY has many fully automatic sequencing machines that perform multiple motions in repetitive cycles, but it is doubtful that any of them cope with as many varying circumstances as does the automatic pinspotter designed and built by American Machine & Foundry Company in its Buffalo, N.Y., and Shelby, Ohio, plants.

Designed for the 20 million Americans who bowl on upwards of 60,000 bowling alleys, the AMF pinspotter does more than set up ten pins in readiness for the bowler's first ball . . . it performs a complex series of motions starting when the bowler's first ball hits the pit cushion at the end of the alley.

• Here are some of the things it does in rapid, accurate order at a rate varying from seven-and-a-half to nine games per hour, depending upon the speed of the bowler.

• It detects promptly and infallibly whether the bowler has made a strike or left any combination of pins standing, and responds accordingly.

• It distinguishes between the first and second ball, clearing away the deadwood between balls without changing the exact position of pins left standing.

• It returns the bowler's ball to him, but places a guard across the alley to prevent him from damaging the machine by throwing the ball before the pinspotter has completed its "work".

• It keeps an extra set of pins in constant readiness, whether the table is in normal or respotting position, so that there will be a minimum delay in placing the next set-up.

• By means of auxiliary screen and indicators, it shows the bowler a strike, pins left standing, first and second ball, and foul.

How it does this is revealed in the six accompanying photographs which show how the pit looks to the bowler, what happens after the first ball is thrown, and the process of clearing away the deadwood and positioning the

Continued next page

pins for the next action.

The problems in designing this electro-mechanical system were many, and required several years of engineering development to perfect. No less difficult have been the many manufacturing problems concerned in producing the components.

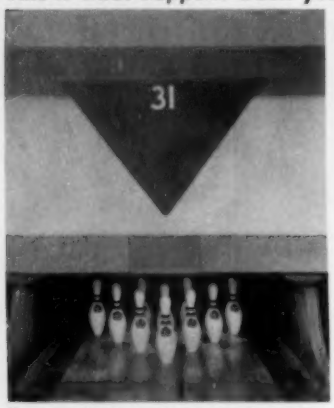
The hard-working components of this machine need durability, accuracy and stability under the most severe service conditions. No bowling alley operator can tolerate interruption of his tightly-scheduled league games because of machine breakdown. Rules of the American Bowling Congress which has approved the AMF Pinspotter are specific with regard to the accuracy and dependability required.

It is not surprising, then, that American Machine & Foundry engineers have found several precision metal molding processes most suitable for components in the automatic Pinspotter. While it is not possible to review, in detail, each of the many die, permanent mold and shell mold castings used effectively in the machine, the following pages contain what are believed to be the outstanding examples of each.

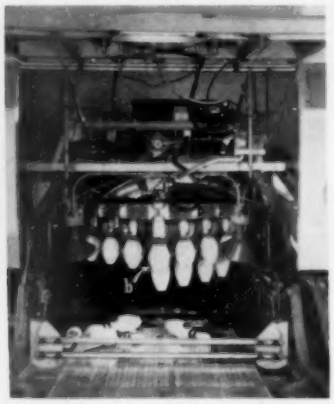
TABLE I: Typical tooling costs for Pinspotter components

Part	Material	No. Machine	Weight	Die Cost
DIE CASTINGS				
Respot actuating pad	Aluminum (S-9)	10	.909 lb.	$11,545.00
Arm cap	" "	5	.111	8,050.00
Crank	" "	2	.993	3,475.00
Arm assembly	" "	1	.133	1,595.00
Spotting cup (R.H.)	" "	10	1.719	14,190.00
SHELL MOLD CASTINGS				
Distributor track	Meehanite	1	4.000	4,375.00
PERMANENT MOLD CASTINGS				
Table channel	Aluminum (356-T6)	2	15.000	5,100.00

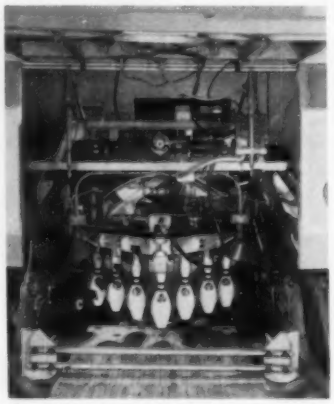
This is what happens when you bowl . . .



1. BOWLER'S EYE VIEW of the pit end of alleys outfitted with AMF Automatic Pinspotters. Electro-mechanical system performs all pit services conventionally done by hand. Screen above alley indicates strike, first and second ball, foul and pins left standing by number and position.

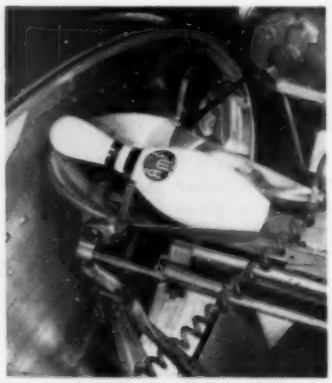


2. FIRST BALL sets the machine in motion, shown with screen raised to reveal mechanism. Ball has already been lifted by an elevator and sent back to the bowler. Standing pins have been lifted by the spotting table so that the combination sweeper and guard can clear away the deadwood.

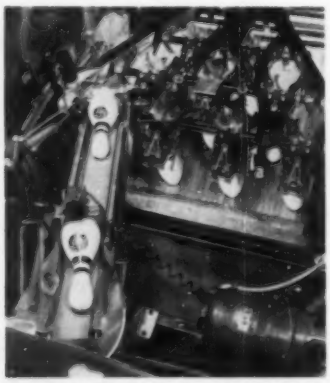


3. NEW SET OF PINS is lowered to the alley bed following a strike, foul or a second ball ending a frame. If pins are left standing after the first ball, the spotting table sets them back in their exact location after the sweep has cleared the alley. No part of the machine ever touches the alley bed.

4. PINWHEEL CONVEYOR at rear of the Pinspotter receives the deadwood carried beneath the pit cushion by the machine's endless "magic carpet" and carries them upward. Pins are held in wheel's compartments by steel rods in die cast guides, and then deposited base-first into an orientor.



5. AT TOP OF THE PINWHEEL, the tenpins are released base-first onto a telescoping distributor whose endless belt indexes pins into cups of the spotting table. Supporting head for the distributor and other parts are die cast.



6. TELESCOPING PIN DISTRIBUTOR, whose front end has a small pinion, is guided about the triangular distributor track (a) to supply pins for the ten spotting cups. This action takes place at all times when the table needs pins, even when spotting table is lowered to respot.

SHELL MOLD CASTINGS replace a 25-piece welded assembly

AMF Builds An Automatic Pinspotter

7. REPLACING A $150 machined weldment, this distributor track is shell mold cast in Meehanite. It was originally made as a 25-piece welded assembly with upset teeth. Detail of the teeth, corner piece and stops is shown at left.

How the pins are distributed to the ten spotting cups to be in position for the next set-up can be seen in the view, Figure 6, which shows the telescoping pin distributor carrying pins on an endless belt ready for delivery to the appropriate cups, as signalled by the machine's electrical control system.

The pin distributor has, at its outer end, a pinion which engages a triangular rack (a) that guides it from position to position and provides stops to hold it while it discharges each pin.

A key component in this maneuver is the triangular distributor track, Figure 7, with teeth accurately formed around the entire periphery. If straightened out into a single strip, it would be a 6½-foot rack.

Originally, this track was made of half-inch cold rolled steel in two sections. The assembly consisted of the two pieces of track, three corner plates, and ten stops, plus wear plates that were bolted to each stop in order to resist repeated impact . . . a total of 25 pieces plus bolts.

The problems of holding tolerances, especially flatness, were of major proportions on this large weldment. Tolerance on flatness is ± 1/16" over the entire area.

Just as great a problem was the forming of teeth. After welding, a carbide tool was used to form the teeth by upsetting, but this $60 tool lasted only for four tracks. An attempt was made to produce the teeth with an end mill, but it was impossible to hold close enough accuracy around the track.

Sand casting was the next effort to replace the welded assembly whose finished cost of $150 apiece was beyond practical limits. The trouble with sand castings came from the surface quality of the teeth, even using a so-called precision sand casting. Roughness of the teeth produced excessive wear on the pinion, causing the distributor to jam in tracking from cup to cup.

Shell mold casting in Meehanite was then tried and, after preliminary foundry problems were solved, it has proved to be the most satisfactory and economical method of production. Two suppliers, Builders Iron Foundry and Blackhawk Foundry are supplying them.

At first, the critical dimension from the top of the rail to the surface of each stop was outside the ± .008 allowed, and it was necessary to spot face each stop. It was also necessary to drill and countersink six mounting holes. Now, it is possible to obtain shell castings so accurate that neither operation is needed.

The face of each stop is flame hardened to a depth of .020 to resist abrasion and impact, and the entire track is electrofilm-coated with graphite that serves both as rust preventative and surface lubricant.

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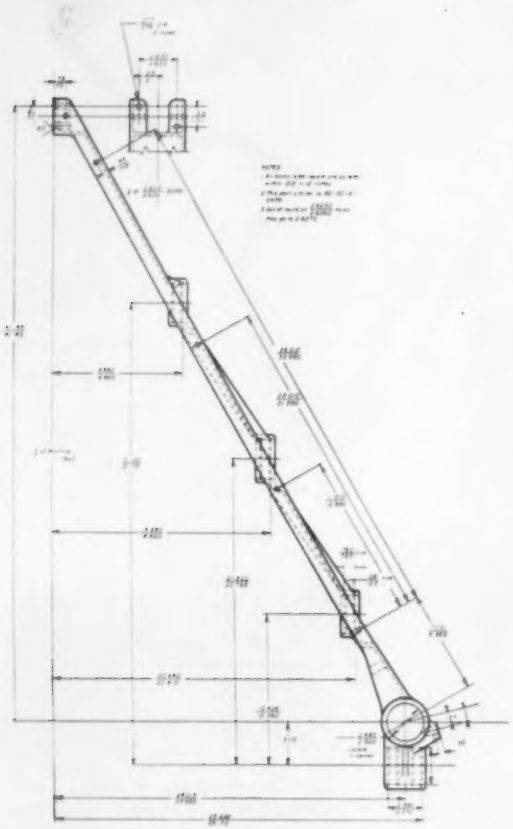
PERMANENT MOLD CASTINGS solve a warpage problem



8. LONGEST CASTING is this 54-inch permanent mold cast side frame for the spotting table. Freedom from warping and distortion are distinguishing characteristics of this piece.

Largest of the precision types of castings in the AMF automatic pinspotter is a 15-pound aluminum permanent mold casting, the table channel.

Remarkable tolerances of accuracy, straightness and angular relationships are maintained in this 54-inch long casting. A pair of these castings form the right and left sides of the table which carries the entire pin spotting mechanism, Figure 3c.

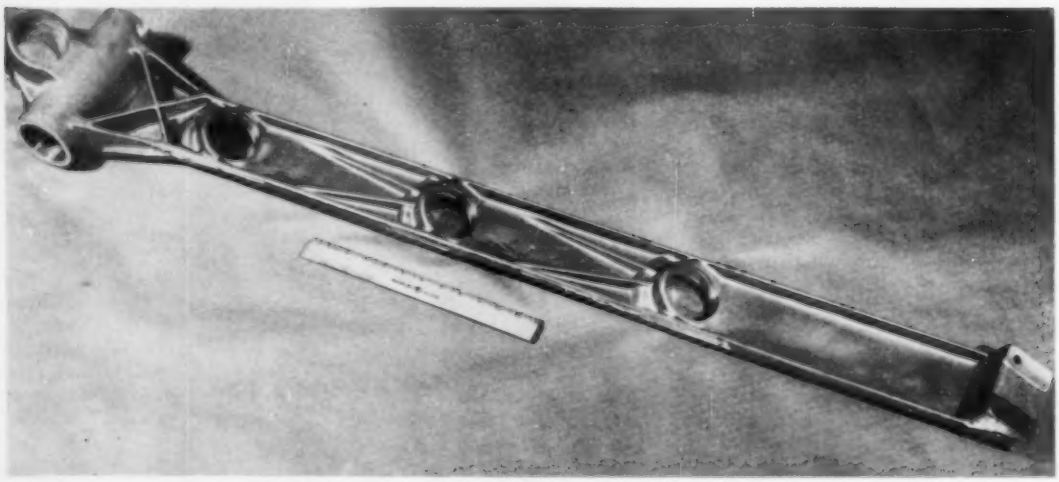
As a sand casting during early development of the machine, there was difficulty in getting the cored holes for the cross bars within constant relationship. Warpage was severe, and the rate of rejects due to twisting of the castings was prohibitive. Shrinks in the long section were likewise unpredictable and disastrous.

The advantage of the permanent mold casting for this large frame has been that, once the mold is made and cores accurately positioned, there is no problem of core shifting. All relationships are fixed by the steel mold. The drawing indicates the dimensional and angular relationships.

These permanent mold castings are held within 1/32" on straightness and flatness over the entire length, while all angular holes are bored square and parallel with each other within .012 per foot. The foundry, Michigan Wheel Company's Permanent Mold Casting Division, produces the side frames in aluminum alloy 356-T6.

These castings carry an unusually heavy load, and therefore need not only high strength, but good stability upon aging. These castings have been satisfactory in both respects.

AMF Builds An Automatic Pinspotter



DIE CASTINGS match a difficult contour

A total of 77 die castings go into each automatic pinspotter, some relatively simple in shape, others with accurate contours and dimensions that would be expensive to duplicate by any other method.

An impressive example is the spotting cup, Figure 9, which can be seen installed in the machine at (b) in Figure 2.

While waiting to be positioned on the bowling alley, the pins are stored above the alley in ten cups, supported from the "table". These cups are made up of a pair of aluminum die castings.

As first designed, these spotting cups were formed from spot welded ¼" wire, shaped to hold the bowling pins. Functional difficulties immediately were found. The wires tended to mark the bowling pins. This process was also far too expensive for production, so other methods were investigated.

Solid castings made in sand molds were tried, but the cost of finishing was exorbitant. Inside surfaces in contact with the bowling pin must be exceptionally smooth, and to develop this on a sand casting required many grinding and polishing operations.

It was also found that the one-piece pin cup became as loud as a bell when pins dropped into it, raising the noise levels too high. In redesigning the cups as die castings, therefore, the cups were split into right and left halves, with rubber pads between to deaden the noise.

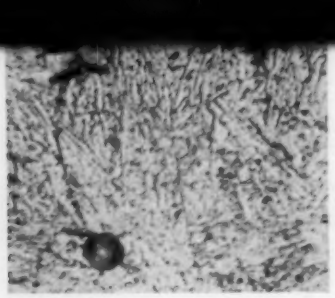
Very little finishing is needed on the die castings, and so piece costs have been reduced. Interior surfaces are chromium plated to prevent the aluminum from marking the pins.

So accurate are these die castings that the only machining needed is to broach one slot. The internal contour, a very critical shape needed to release the pins properly onto the bowling alley, is achieved by die casting.

Because of the repeated impact, the pin cups are heavily ribbed, with ample fillets to withstand stress. These ribs and fillets also help the smooth distribution of molten metal in dies, avoiding turbulence that might weaken the casting.

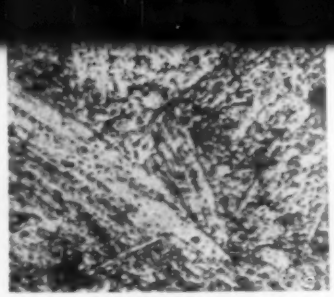
The spotting cups are die cast in aluminum alloy (ASTM S-9) by the Doehler-Jarvis Division of National Lead Company, who also furnish 75 other aluminum and one zinc die castings for each machine. A tabulation of castings per machine, weight of each, and die costs, is in Table 1.

9. SMOOTHLY BLENDED CONTOURS inside this pair of aluminum die castings receive the tenpins, hold them in the spotting table, and release them properly onto the bowling alley as needed. Inside surfaces are hard chromium plated. A total of 77 die castings go into each pinspotter. At the left are representative castings.

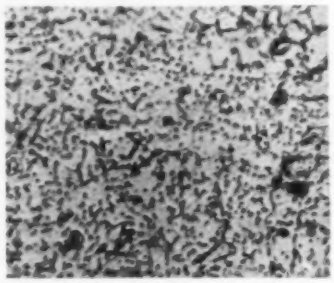


SPECIMEN 1. As-cast structure showing very coarse accicular martensite.*

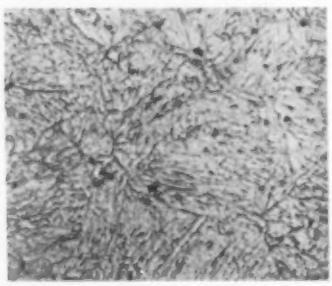
SPECIMEN 2. Improperly annealed and homogenized material, no carbide precipitation.



SPECIMEN 3. Incompletely annealed material. Homogenization of the accicular material incomplete.



SPECIMEN 4. Properly annealed metal. Homogenization is complete. Ferrite matrix with carbide precipitated.



SPECIMEN 6. Fine grained, tempered martensite resulting from the recommended heat-treatment.

How Six Heat Treatments Compare

Specimen Number	Annealing	Hardening	Rockwell Hardness	Remarks
1	—	—	44 "C"	As Cast
2	1350° F for 5 min., air cooled	—	20 "C"	Incomplete homogenization
3	1350°F for 30 min., air cooled	—	91 "B"	Incomplete homogenization
4	1600°F for 2 hrs., cool to 1100°F in cast iron chips at rate not exceeding 50°F/hr., then air cool to room temp.	—	77 "B"	Recommended anneal
5	1350°F for 5 min., air cooled	1875°F for 5 min., oil quench, then temper at 1050°F for 1 hr.	41 "C"	Example of erratic heat treatment
6	1600°F for 2 hrs., cool to 1100°F in cast iron chips at rate not exceeding 50°/hr., then air cool to room temp.	1800°F for 30 min., oil quench, then temper at 1040°F for 1 hr.	34 "C"	Recommended heat treatment. (Fine grained homogeneous tempered martensite.)

*All specimens 1000X, etched in aqua regia, reproduced full size.

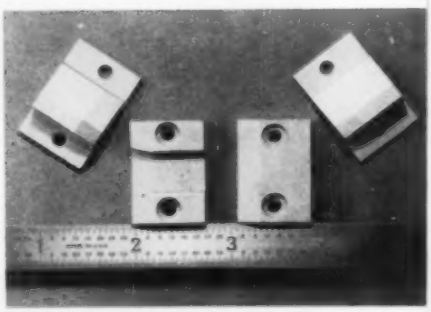
Uniform Hardness For 410 Stainless Castings

By DR. W. B. F. MACKAY
University of Minnesota

SMALL investment castings made out of 410 stainless steel (0.15% C max., 11.5—13.5% Cr, bal. Fe) may on occasion give erratic hardness results after heat treatment. The annoyance of having to re-work the odd batch of castings during a long run needs no amplification.

Such a case was recently encountered with a small aircraft fitting (max. section $\frac{3}{8}$") for Boeing Airplane Company. The specifications for the part in question called for a tensile strength of 150,000-170,000 psi (32-36.6).

In an attempt to eliminate this problem and assure positive quality control, a study was carried out on the effectiveness of various heat treatments. This investigation was a three-way proposition: Dean Precision Castings, Inc., Minneapolis, handling the foundry work; Northwest En-



1. Investment cast, 410 stainless steel parts that have been hardened successfully by the recommended procedure.

gineering Laboratories, Inc., Minneapolis, the heat treating; and the writer, as a consultant to the first mentioned concern, the laboratory work.

No claim is made on the basis of originality for the final heat treating procedure arrived at. It is submitted only in the hope that it may point up some of the underlying principles involved and be of interest to others in the industry.

The heat treatment being followed on these castings may be classified broadly as a two stage procedure (a) full annealing to homogenize and eliminate the "as cast" structure, (b) quenching and then tempering to the desired hardness level.

Annealing

The accompanying chart indicates for illustrative purposes a few of the heat treatments investigated. Here the "as cast" structure of specimen No. 1 has a hardness of 44 R_c. This rather hard and brittle structure contained some martensite and possessed a very acicular or needle-like microstructure. Specimens 2 and 3 show the drop in hardness obtained with low temperature and short time anneals. Despite the marked drop in hardness the microstructure is still acicular, and homogenization is far from complete.

Specimen 4 has been given the recommended anneal. Here the microstructure has been fully homogenized and consists of small carbides scattered in a ferrite matrix. To obtain consistent hardening results it is imperative to homogenize the "as cast" structure. This requires adequate time at temperature.

It is felt that, on very small parts, there may be a tendency to cut down on the time at temperature—especially when a significant drop in hardness can be shown for short time intervals. This is misleading, especially on highly alloyed steels such as 410, where the chromium carbide has a considerably lower rate of diffusion than pure iron carbide. To obtain complete solution of the complex carbide into the austenite, it is necessary to maintain the steel at temperature for a longer time or at higher temperature than is common for plain carbon steels.

Hardening

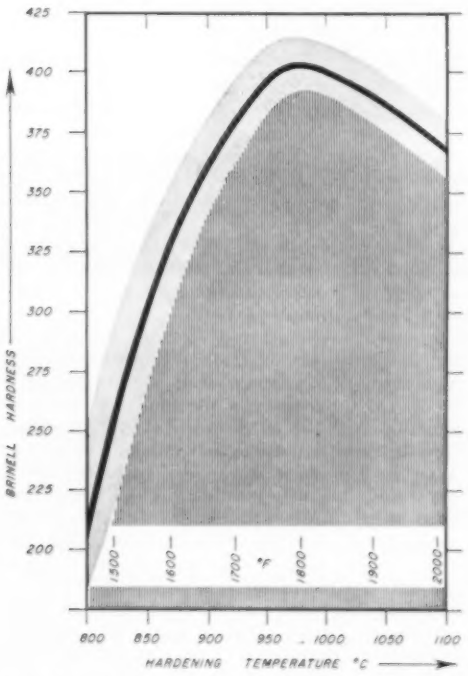
The hardening temperatures for maximum hardness are shown on Figure 2 to lie in the range of 1700-1850 F. Heating below 1700 F does not complete the austenization of the structure, while heating above 1850 F increases the percentage of retained austenite after quenching.

The test results substantiated this graph as a hardening temperature of 1800 F (see Chart) was found most suitable. The "as quenched" hardness of the small parts was somewhat higher than the usually accepted 42 R_c. Oil quenching is recommended over air for more consistent results.

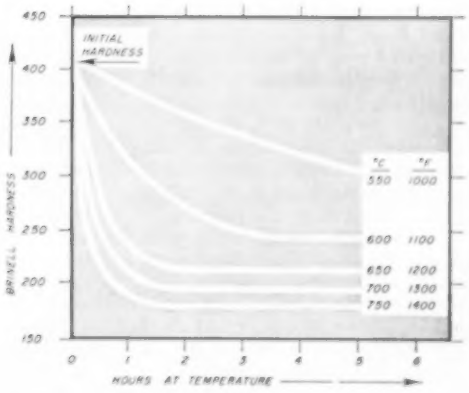
The curves in Figure 3 present an overall picture of the effect of time and temperature on the

Continued on page 88

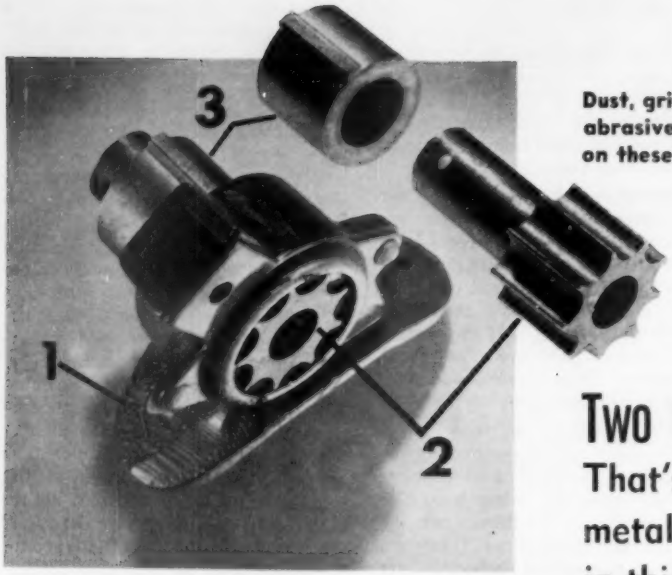
Recommended heat treatment gives dependable hardness



2. Relationship between hardening temperature and hardness for 403, 410 and 416 stainless steels. (From "Stainless Steels" by C. A. Zapffe, courtesy ASM.)



3. Relationship between time at hardening temperature and hardness for 403, 410 and 416 stainless steels. (From "Stainless Steels" by C. A. Zapffe, courtesy ASM.)



NICE FIT of mating parts comes naturally to powdered metal parts but had to be achieved by machining when these were sand cast. Parts 2 and 3 above have been converted to powder metallurgy.

Dust, grit and other abrasive materials have little effect on these parts.

Two Out Of Three . . .

That's the score for powdered metal over sand castings in this agricultural device

BY changing from an iron casting to a powdered iron part, the manufacturers of farm equipment have virtually eliminated machining on the grass seed cups used to regulate the amount of grass seed spread. As can be seen, from the illustration, a seed cup consists of three major parts: the cup itself, a fluted feed roll and a cut-off. Cockshutt Farm Equipment, Inc. has converted two of the three parts to iron powder compacts that are accurately enough made so that all machining has been eliminated on them. The cup member is still a gray iron casting which must have some work done on it after it is received from the foundry.

Functionally, the device is quite simple. The cup is kept filled with grass seed from a hopper. As the fluted roll revolves, each flute picks up a fixed volume of seed and discharges it through an opening in the bottom of the cup. To vary the amount of seed picked up, more or less of the flutes are covered by the cut-off, a cylinder which fits over the fluted roll and which can be locked into any position from 100 percent open to 100 percent closed.

Like all farm equipment, this seeder operates under the most adverse conditions possible. Dust, grit and other abrasive material are always present in large quantities. Because the device must pick-up and discharge cleanly, no oil can be used to reduce wear. Uniformity of feed depends upon uniform flute volume and a good fit is required to prevent jamming seed between the crests of the flutes and the cut.

All of these operational factors required that both the roll and the cut-off be machined all over to secure the nicety to fit and contour required. Machined all over, that is, when they were made of cast iron. Since the change to metal powder, however, all machining on these two parts has been eliminated. They are used as received from the fabricator.

The savings made possible by converting to an iron powder part have been impressive. Each seeder uses a plurality of feed cups and from year to year the design is frozen. This enables the manufacturer to amortize the tooling over many years.

The men and the machines that were formerly employed in machining the iron castings are now used for other production work so that increased plant production has been possible without either more machines or more employees.

Jigs and fixtures, as well as special tooling required for the job, have been eliminated, thus decreasing the tool room load.

A single inspection, at the time the parts are received, now replaces the several inspections formerly necessary. Once parts have passed this initial inspection, there are no further rejects due to hidden defects exposed by machining.

Inventories are cut in half since only finished parts are stocked instead of raw castings and finished parts. Finally, every step that reduces the amount of machining also reduces housekeeping costs.

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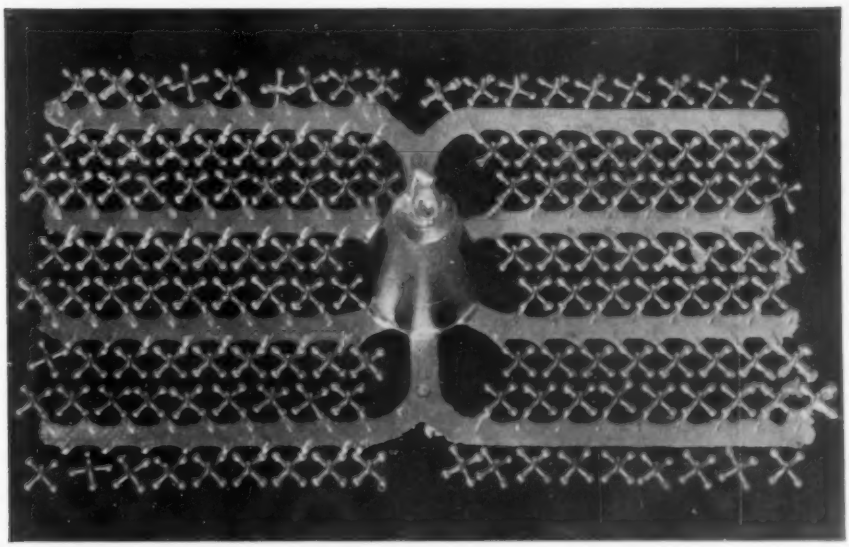

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Which alloy for your investment casting? Before you decide, give some thought to

Castability: Its Effect On Alloy Selection (Part One)

By **WALTER A. DUBOVICK,** Engineered Precision Casting Co.

A FACTOR often overlooked and even disregarded by the prospective user of investment castings is the amazing diversity of castable materials which the process places at his command. The materials range from the aluminum base alloys to special high temperature alloys with melting points above 2700 F.

Furthermore, the same tools can usually be used without change for any of these materials. Where other casting methods, by their nature, limit the use and selection of materials to a very narrow range, many investment casting producers can successfully cast metals almost without regard to melting point or basic composition.

Unfortunately, although practically any material can be cast, the results, or yield of saleable castings, can vary considerably. We thus find that although the theoretical range of useful materials includes nearly all commonly known metals and alloys, economic considerations reduce the availability for use to those which the producer has found through experience that he can cast with a reasonable and predictable number of rejections from all causes.

It is also synonymous that if one producer finds a certain alloy to be exceptionally easy to cast, other manufacturers using similar equipment will have comparable success, so that these materials enjoy preferential status throughout the industry. These universally accepted materials can be used as yardsticks or standards when considering or comparing castability of any other material of similar composition.

The problem of materials selection, for normal structural applications of investment castings, is resolved to the simple task of compiling a list of these preferential materials and then choosing the one most suitable for the application.

Some firms with special skills or experience can undertake to cast metals on a commercial basis that other firms without such skills will consider impractical. We must assume that the individual upon whom rests the responsibility for the selection of the material does not have a list of such qualified firms to choose from and, if he did, purchasing procedure normally would not permit such a limited source of supply.

He must also consider possible disruption of production schedules or even the crippling of an entire project which might occur if it were dependent upon deliveries of castings from a single source. Time lost in finding an acceptable substitute material and supplier could be irreparable. A material should of necessity be chosen that will satisfy design requirements and still be acceptable to most producers.

WHEN the Atomic Energy Commission wanted to know how they could use more investment castings, they invited a panel from the Investment Casting Institute to give them an authoritative report. This article is based upon a paper, "Castability of Materials for the Investment Process," was given before the meeting sponsored jointly by the Sandia Corp. and the Albuquerque chapter of ASM.

On the other hand, it would be foolish to arbitrarily disqualify a material required for a special application simply because of limited acceptance by the investment casting industry. Unusual applications require special consideration. When occasions arise which indicate that a normally poor casting material will be the only one which will be suitable for the function required, it would be wise to get the opinion of several reputable casting producers before abandoning its selection as being impractical.

Factors and Conditions Affecting Castability

It was mentioned that for conventional purposes there exist a number of materials which might be considered as the work-horses of the industry because of their good castability. It was noted that other materials could also be used, but not all producers are able or willing to use them because of their poor castability. If this factor is so important, what distinguishes a good casting material from a poor one? The ideal casting material has all of the following qualifications:

1. Good Fluidity
2. Low Melting Point
3. Beneficial Solidification Range
4. Low Gas Solubility
5. No Detrimental Surface Decarburization
6. No Hot Shortness
7. Good Chemical Reproductility and Alloying Efficiency
8. Good As-Cast Surface Finish

These qualifications represent most variables which govern castability and general acceptance of a particular material. Their manifestations may appear singly, in which case the cause can be easily identified and corrective action taken, or they may act in combination to produce a high rate of rejectable castings which may be puzzling to explain.

In either event, the producer, once having encountered them, will be extremely reluctant to use them again. In order to evaluate castability in terms of these qualifications, we find it necessary to further identify and to learn what particular function they have in affecting castability or use from the producer's viewpoint.

1. FLUIDITY . . .
the ability to flow easily through narrow passages or orifices.

One of the keys to the versatility of the investment process is that the metal is poured into relatively hot molds. Mold temperatures for casting vary from a low of 300 F for aluminum alloys to as high as 1800 F for some ferrous and super-alloy compositions. This wide range of permissible mold temperature helps the investment foundry overcome most of the difficulty in filling out thin sections due to lack of fluidity.

If the metal fails to fill out a mold cavity satisfactorily, the mold temperature can very easily be increased to help the metal retain its pouring temperature while it is filling the cavity. Pressure, centrifugal, and suction casting can be used to help the flow of metal. For most materials, we can safely say that fluidity plays a smaller part in determining its castability than would be expected because of external means that can be used to assist the flow. The exceptions to this rule occur primarily with the light alloys, where the weight of the material in the risers provides insufficient hydrostatic pressure to force the material through thin sections, and designs requiring thin edges and sharp detail in the high melting point alloys.

2. LOW MELTING POINT . . .
when compared with other materials in its group and in consideration of investment used.

This factor is one of the most important in determining the castability of a particular material. In order to understand the critical nature of this property, you must remember that traces of wax or plastic pattern material, or, perhaps, some tramp organic material, which may have found its way into the investment, may still exist in the investment mold even after careful firing. The residues would be carbonaceous in composition.

Let us consider that aluminum alloy #356, with a melting point of about 1075 F, is poured at 1150 F into a mold containing a trace of carbonaceous wax residue. Let us also assume that the metal enters the mold without volatilizing this residue but that volatilization is on the verge of taking place at this pouring temperature. If, instead of aluminum 356, we used pure aluminum 2S, with a melting point of about 1215 F, at a pouring temperature of 1300 F, the volatilization which did not occur when the lower temperature material was used now becomes evident and sufficient gas is formed within the mold cavity to prevent its complete displacement by the metal. The mold cavity will not fill out and a miscast is the result.

Two types of investment materials are generally employed by producers using wax or plastic as their disposable pattern material. A plaster base investment is used for low temperature work and a silica base investment for high temperatures.

The plaster in this type of investment will begin to decompose rapidly at about 2300 F which limits its use to materials which can be poured under this temperature. Decomposition of the plaster by high temperature induces gasification within the mold cavity with resultant loss of the casting.

The silica base investment has a softening or fusing point of about 2800 F which limits its use to materials which can be poured at temperatures that will not cause this fusing to take place. Pouring temperature above 2800 can be and are often used because the metal in contact with the mold walls, which are much lower in temperature, loses much of its heat and consequently is at a temperature that is below the fusing point of the investment even though the main body of molten metal may be above this temperature.

If the metal that comes in contact with the mold does not lose enough heat for its temperature to drop below the fusing point of the investment, a reaction may take place at the surface of the casting which usually means its rejection. Metals, with melting points close to or above the fusing point of the investment, will naturally produce more defective castings due to this effect than metals with melting points one or two hundred degrees lower.

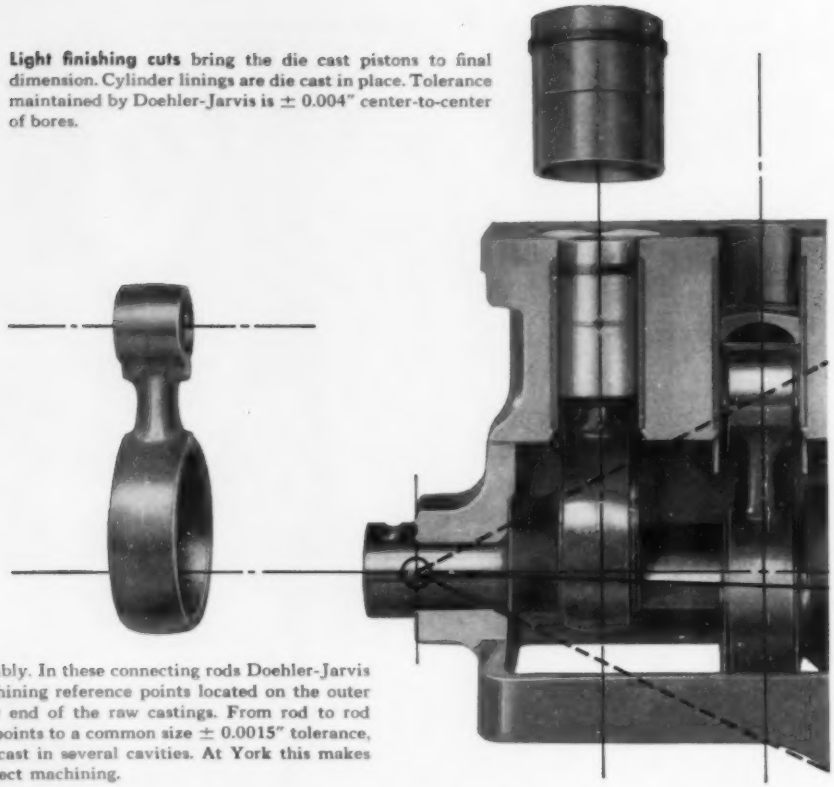
3. BENEFICIAL SOLIDIFICATION RANGE . . .
the differential between the temperatures at which solidification begins and ends.

This factor is as important as the melting point described above. It is this property which permits feeding and makes it possible to use the principle of directional solidification effectively. It determines the gating required to produce a sound casting. It explains why a gating system which produces a sound part in one material will make a casting which is full of shrinkage porosity when using another.

It is common knowledge that a small addition of an element to a pure base metal will lower its melting point, and, at the same time, change its solidification pattern. A good illustration of this behavior is pure iron and iron with .5% carbon. The melting point of iron is 2795 F plus or minus 2°. The iron melts and solidifies at the same temperature. There is no solidification range. The iron with .5% carbon, on the other hand, starts to freeze or solidify at about 2720 F and the

Continued on page 48

"Where other casting methods, by their nature, limit the use and selection of materials to a very narrow range, many investment casting producers can successfully cast metals almost without regard to melting point or composition . . ."



Light finishing cuts bring the die cast pistons to final dimension. Cylinder linings are die cast in place. Tolerance maintained by Doehler-Jarvis is ± 0.004" center-to-center of bores.

Cast-in chamfers aid assembly. In these connecting rods Doehler-Jarvis dies also establish two machining reference points located on the outer circumference of the throw end of the raw castings. From rod to rod Doehler-Jarvis holds these points to a common size ± 0.0015" tolerance, even though they must be cast in several cavities. At York this makes for smooth, precise, low-reject machining.

How Doehler-Jarvis helped make hermetic compressors lighter and

This is a story of practical product engineering.

Its concern is with things you may want for your product. Reduced size, weight, cost. Stepped up efficiency. Increased life. These were what York Corporation wanted for its post-war "packaged" air conditioners.

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Cool! Light, small die cast compressors make York Window Conditioners compact, efficient and good for years of trouble-free service.

Three cost factors favor die casting

1. Raw castings cost less (less metal to buy)
2. Less machining was needed (less waste, fewer man-hours)
3. Tooling requirements were lower (fewer tools, lighter and less costly)

With these factors in mind, York took their two-cylinder, ¾ H.P. compressor* as a starter and went into production. Within a few years their whole line was converted to the new die cast design. Later . . .

York sees a way to cut size and weight even more

Doehler-Jarvis was asked to incorporate compressor and motor housing into a one-piece die cast unit. A series of conferences followed.

Together, engineers from both companies solved one problem after another. Precise dimensional control. Cast-in-place cylinder linings. Die cast bearing surfaces. Concentricity and precise location of cylinder center lines. (To solve this one, Doehler-Jarvis had to provide in the

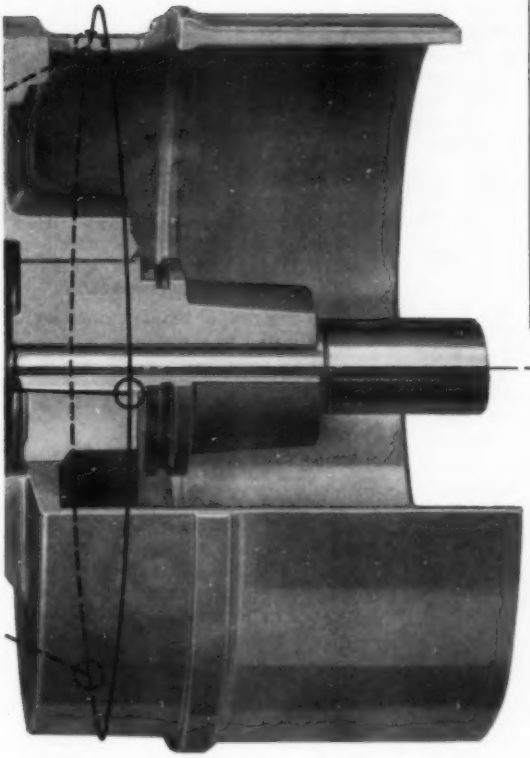
Test units, run continuously ever since, have logged over 70,000 hours without failure.

"Phantom" control cone, with three "no tolerance" chucking surfaces, establishes precision

In the raw casting three equidistant chucking surfaces are established by the Doehler-Jarvis die. Their centers are located on a circle concentric with and exactly perpendicular to the shaft. The plane thus established forms the base of a "phantom" control cone (see illustration) whose apex is at the small bearing bore.

From this cone as a reference, all center lines and true surfaces throughout the piece are established. All machining setups, too, are based upon it.

At the Doehler-Jarvis plant, great care is taken to hold the chucking surfaces true. Aside from very slight variations in cooling, no tolerance is allowed. As a result, York machining proceeds smoothly with minimum rejects at every stage. What's more, the resulting precision insures long wearing bearings, long life pistons and cylinders.



more compact through die casting

die for three "no-tolerance" chucking surfaces on the raw casting . . . precisely located with respect to the front bearing bore.)

This expert product engineering team went on to develop for other sizes other integrated die cast housings, and the connecting rods, pistons, main bearings, and oil slinger rings. These compressors are light, compact and highly efficient. They can be produced quickly and easily.

"Cannot be matched for low cost," York says

"What's more, because the parts can be die cast in a hurry . . . and because Doehler-Jarvis never fails us on delivery . . . we stay flexible. We're able to meet peak demands for air conditioners without going overboard on finished inventory."

Come back to the things you want to do for your own product . . . maybe Doehler-Jarvis could help you do them with die castings. We've done it for scores of manufacturers, large and small—including makers of home appliances, office and public utilities equipment, industrial machines, and many other similar products made better with die castings.

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last trace of the liquid phase doesn't solidify until about 2570 F. This gives a range of about 150 F which is enough to permit sufficient feeding to take place to insure the production of reasonably sound castings.

As the carbon content increases, the melting point decreases until the iron can no longer keep the carbon in solution, and the carbon takes the form of free graphite and we have gray cast iron. The decrease in melting point continues until the carbon content reaches 4.3%, larger carbon additions would then begin to raise the melting point.

In other words, small additions of elements to a base metal will beneficially reduce the melting and increase the solidification range, but if these additions are made large enough, they reverse this tendency and begin to introduce factors such as segregation and dispersed porosity which will again adversely affect the castability.

A notable exception occurs in adding nickel to copper, where we find that the melting point is actually increased. There are other exceptions, but, in general, the materials commonly used follow this rule.

The addition of small amounts of two or more elements further improves the solidification range which makes alloys with several alloying elements usually more castable than those with a single element.

Common commercial applications of this principle are the low melting alloys used in making the elements in electrical fuses and ordinary solder. These alloys contain lead, tin, bismuth, and antimony, each of which has a melting point in excess of 400 F, yet their alloys can have melting points below the boiling point of water.

We have noted the effect of carbon as an alloying element in iron. Other beneficial elements are chromium, nickel, manganese, silicon, molybdenum, and vanadium.

For copper, we have the classic addition of tin, also, zinc, silicon, manganese, and aluminum.

For aluminum, we have silicon, copper, and magnesium as the most commonly used additions.

It is apparent from these observations that the addition of almost any element will improve castability providing it is made in a quantity that will be compatible with the base metal.

4. LOW GAS SOLUBILITY . . .
the dissolving of gases in molten metals.

Most metals have a solubility factor for gases. They are able to retain a small percentage of gas in the solid state without detrimental effect. In the molten state, much larger amounts can be dissolved and the amount absorbed increases with the temperature and length of time it is kept molten. When cooled to the solid state, the metal cannot retain all of the dissolved gas, and the gas goes out of solution leaving a porous condition known as gas porosity.

This defect is very pronounced in aluminum and copper and some of their alloys. Excess hydrogen, dissolved during the molten state, will cause poor pressure tightness and loss of physical properties in aluminum. Steam formed by the reaction of hydrogen with oxygen dissolved in copper has a similar effect on copper-base alloys. Titanium has a very pronounced affinity for oxygen and nitrogen which makes it impossible to melt in air.

5. SURFACE DECARBURIZATION . . .
The loss of carbon at the surface of the metal.

The effect of decarburization is mainly limited to structural and tool steels. It is not a factor in aluminum and copper base alloys because carbon is not one of their constituents. It has no serious affect on the low carbon or carburizing grades, since the carbon is restored during the carburizing treatment. In the medium and high carbon ranges, loss of carbon at the surface will prevent its hardening during heat treatment.

If decarburization cannot be tolerated in a medium carbon steel, the casting producer may be forced to "regret" the bid, or, in other words, refuse to quote unless he has some means of correcting the condition such as carbon restoration. Addition of carbide forming elements such as chromium and vanadium will reduce the decarburization and an alloy containing these elements should be specified.

The high chromium alloys, such as the 400 series stainless steels, are noteworthy for their lack of decarburization. Timken Alloy 17-22A(s), a low alloy similar to AISI 4130, except for a small addition of vanadium, has less decarburization than other steels in this carbon range. The high carbon-high chromium tool steels are similar to the 400 series stainless steels in this respect.

6. HOT SHORTNESS . . .
The fracture or tearing of a metal during solidification.

The symptoms of hot-shortness are manifested by the appearance of grainy intercrystalline cracks which take place in those regions where the metal solidifies the most slowly and where the metal is still extremely hot (immediately below the melting point) when the fractures occur.

Hot-shortness which may be entirely due to casting design can be made very much more severe through the various impurities which segregate at dendrite or grain boundaries, yielding a lower melting point system as well as a weaker structure at the high temperatures. Elements such as sulphur are extremely bad in all of the ferrous alloys, and especially in nickel and nickel-base alloys where either iron sulphide or nickel sulphide form, depending on the alloy content.

The addition of manganese to steels, for example, prevents hot shortness through the formation of a sulphide which is predominately manganese sulphide, and which has a higher melting point than iron sulphide and has a different mode of solidification and distribution in the structure.

Other elements, such as lead, bismuth, tin, zinc, and arsenic, can also cause severe hot-shortness, for example, lead in stainless steels or bismuth in gold, because the solubility of these elements is virtually nil. This means that these elements end up in the grain boundary, yielding zones of weakness which will fracture at the high temperatures wherever castings are restrained from normal shrinkage on freezing and cooling.

7. CHEMICAL REPRODUCTILITY . . .
The ease with which chemical composition can be held within specification limits.

The range or variation permitted for retention of a specific element of an alloy may determine whether or not it is economically feasible to use it

for casting purposes. Alloying elements are susceptible to oxidation and volatilization in varying degrees. The greater the rate of oxidation, the more difficult it becomes to retain the element.

If the composition range is very narrow, it may be virtually impossible to melt and pour the alloy and still keep the element within the allowable limit. The loss of elements in high-temperature alloys (alloys with melting points above 2300 F) during melting with electric high frequency induction furnaces is approximately as follows:

Aluminum	60%	Nickel	0%
Chromium	10%	Tungsten	0%
Titanium	80%	Cobalt	0%
Manganese	10%	Tantalum	50%
Silicon	20%	Vanadium	50%
Carbon	10%	Columbium	
Copper	0%		30-40%
Molybdenum	0%		

The figures given are the maximum losses which can usually be expected.

The amount and rate of loss are dependent upon length and temperature of the melting operation. It can be controlled to some extent through proper foundry techniques such as making additions to the molten metal to compensate for the anticipated loss. If the composition limit is so strict that the foundry cannot maintain the analysis of the cast metal, with existing plant facilities, the alloy must be classified as non-castable.

Changes in composition can also occur due to type of melting equipment. An alloy melted in a carbon arc furnace may pick up sufficient carbon from the electrodes to exceed the upper allowable limit. Plants using these furnaces may find it impossible to meet the specification for extra low carbon stainless steel commonly known as 304 ELC. The maximum allowable carbon content is .04%. At this low range, the alloy can dissolve carbon faster from the furnace than it will lose through oxidation. It is impractical to counteract this action by passing air through the molten metal as is done in steel plants. Unless an alternate material is specified, the only foundries that would offer to produce castings in this alloy would be those which have induction melting furnaces.

8. GOOD AS-CAST SURFACE . . .
Freedom from surface pitting and heavy adhering scale.

Poor as-cast surfaces can usually be attributed to one or more of the previously discussed conditions. The exceptions are found in those metals which upon contact with the atmosphere form a skin of oxides that have slagging reactions with the investment.

An example is the reaction of manganese in an alloy with silica in the investment which will form a low melting point slag at the surface of the casting and cause slag pockets. Another reaction detrimental to surface appearance is the reaction of iron oxide and silica, if the metal is poured at high temperature.

It is believed that the cause of surface pitting in the 400 series stainless steels is due to the formation of a combination of Cr_2O_3 and FeO with a resultant uneven oxide surface coating.

Some materials, upon solidification, form a very thin non-adhering oxide surface film which permits flaking off of the investment and leaves a fine smooth appearance. The aluminum alloys are notable examples, and silicon brass, beryllium copper, manganese bronze, and aluminum

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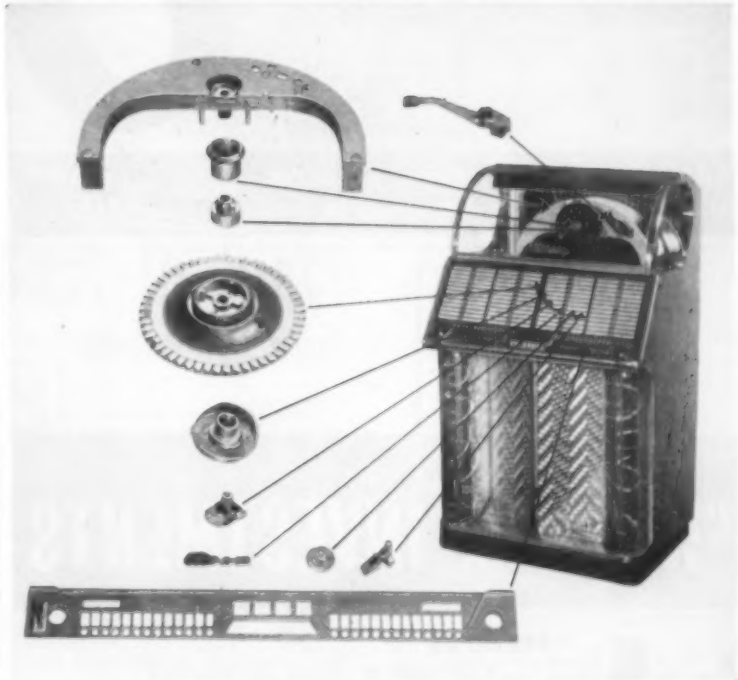

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bronze, in the copper-base group, also have very thin oxide skins, when cast under optimum foundry conditions.

The copper alloys containing tin, lead, and zinc, on the other hand, form relatively heavy scale which upon removal leaves a rougher surface than on silicon brass or beryllium copper. Specifications which call for high surface finish can be troublesome to the heavy skin or scale forming materials.

There is no material, in any of the high temperature groups, which can match the aluminum alloy for freedom from surface scale. The cobalt base alloys, as well as the 300 series stainless steels, have very thin oxide coatings, providing excessive pouring temperatures are avoided, that upon removal, leave surfaces comparable to the better copper base alloy group.

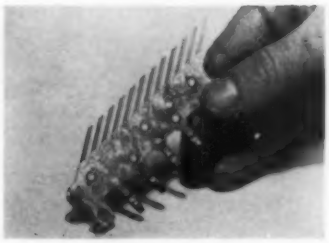
Some tool and alloy steels upon casting also resist heavy scale formation and can be cast with excellent surface finish. The straight carbon steels form rather heavy scale and surface finish is poorer than alloy steels with similar carbon content. Cast iron is a surprising exception, and surface finishes can be obtained equivalent to or better than the 300 series.

When a simple method for producing ductile iron is developed for the investment process, a new structural material, with exceptional casting characteristics will be made available to the designer.

The nickel base alloys excepting those containing more than about 3% Al or 10% Cr have very heavy non-uniform oxide skins. Castings that look fine when the investment is broken away, are actually very uneven when the oxide scale is removed. The surfaces become poorer as section thickness increases due to the greater time required for the larger mass of metal to solidify. Close control of metal pouring temperature and low investment mold temperatures are required to prevent the oxide skin from developing slag pockets which will mar the surface.

Editor's Note: In part Two of this paper, to be presented in July, Mr. Dubovick discusses specific alloys and alloy groups, commenting upon casting characteristics of each.

1.



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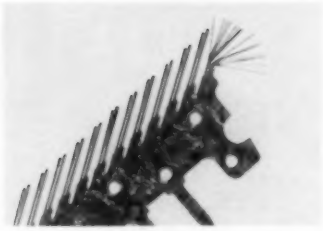
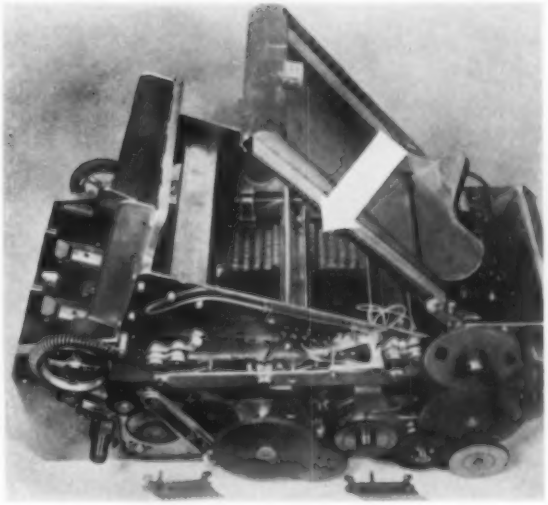


TWELVE SETS of wire strands, with 16 wires per set, are cast as inserts within very close tolerances on position in this die cast zinc sensing bar. Arrow, right, shows where sets of these bars are installed.

3.



192 Inserts Cast In Place

help this business machine to "read".

A HIGH degree of dimensional accuracy at minimum cost is achieved through the use of zinc alloy in a die cast sensing bar used by International Business Machines Corporation, Endicott, New York, in their alphabetical accounting machine. A total of 192 precisely positioned steel wire brush strands are cast in place during fabrication.

An assembly of steel stampings was initially considered for the sensing bar. Experimentation with this method clearly indicated that cost of fabrication would be high. In addition, it was found to be virtually impossible to maintain dimensional tolerance specifications called for on the engineering drawing.

Once die casting was determined to be the fabrication method capable of the close tolerance necessary, aluminum and brass were considered as possible materials. These were discarded, however, in favor of zinc alloy because it is generally regarded as the material easiest to die cast. Despite relatively thin sections and the quantity of inserts involved, zinc alloy proves functionally satisfactory in this application.

The Sensing Bar

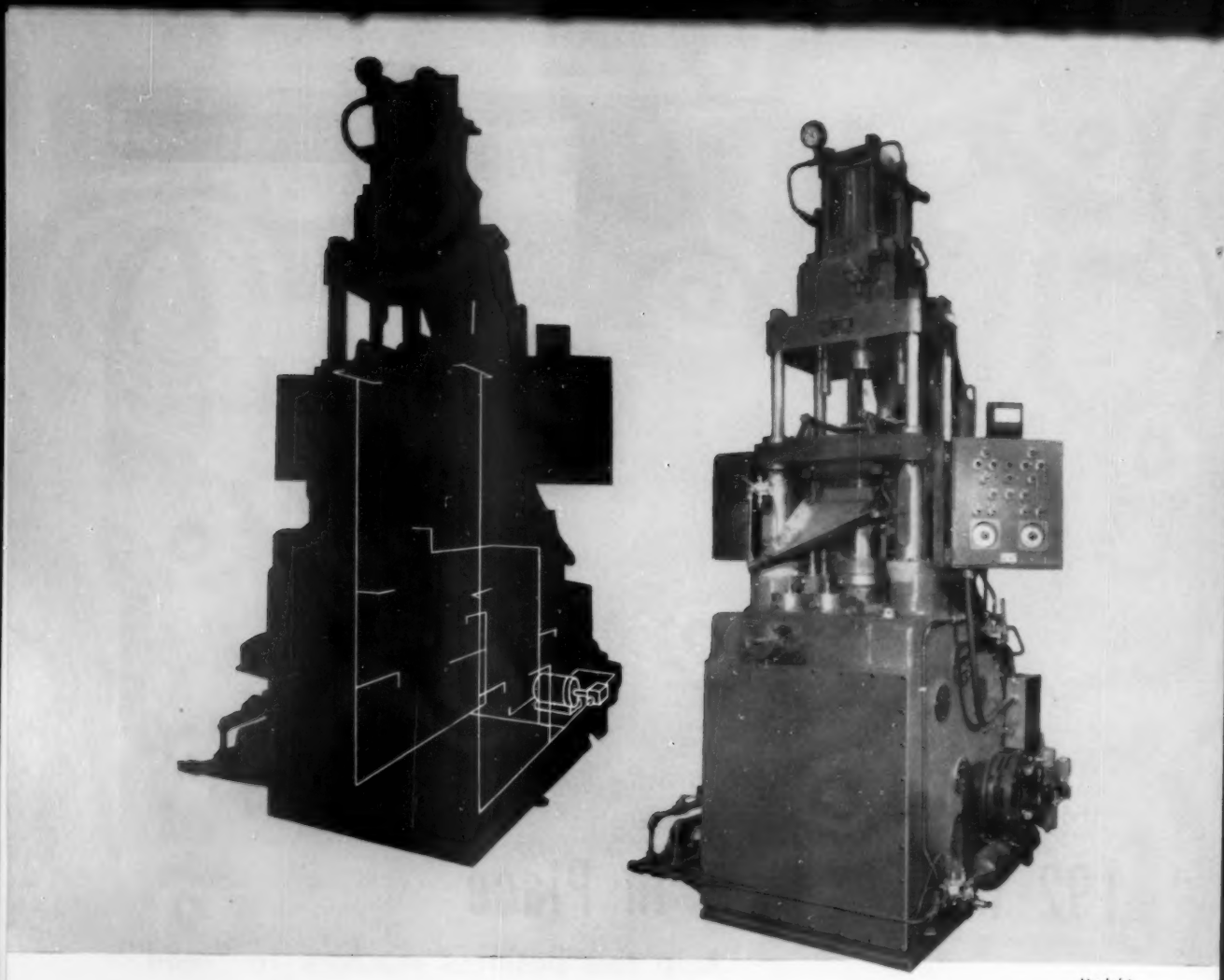
The sensing bar, Figure 1, is a unique die casting because of the unusually large number of inserts cast into it and because of the high degree of dimensional accuracy required in positioning these inserts. Twelve sets of wire brush strands are cast in place. Each set is made up of two groups of eight wires each, Figure 2.

Dimensions for wire strand positioning are held to close tolerances relative to both angular and linear positioning. Furthermore, strands in one group must not touch those in the adjacent group, despite the fact that both groups might be properly positioned with respect to individual group tolerances. The zinc alloy bar, too, is held flat, parallel and dimensionally accurate to rigid specifications.

The bars are assembled in IBM's alphabetical accounting machine as shown in Figure 3. The wire brush strands protrude through a separator plate and as punched accounting cards pass through the machine, the strands "read" the information and relay it to the actuating mechanism of the printing unit.

The sensing bar is cast of No. 3 zinc alloy by Stroh Die Moulded Casting Co. No attempt is made to establish precise strand length when the wires are cast in place; brush strand length at the time of casting must, however, exceed the dimension specified on the engineering drawing.

Following casting, the wires are accurately cut to length. Next follows a series of trimming, sanding and deburring operations after which the parts are carefully inspected, oiled and packed for shipment. Complete fabrication, including inspection and packing, is performed by the die caster.



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Baldwin Model "L" and "C" powdered metal presses are just what you need for highest-quality and lowest-cost production. That's true because these new 50 and 100 ton presses are the first designed specifically for compacting metal powders.

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For more details about "L" and "C" please write to our Dept. 3856, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa.

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EDDYSTONE DIVISION

BALDWIN-LIMA-HAMILTON

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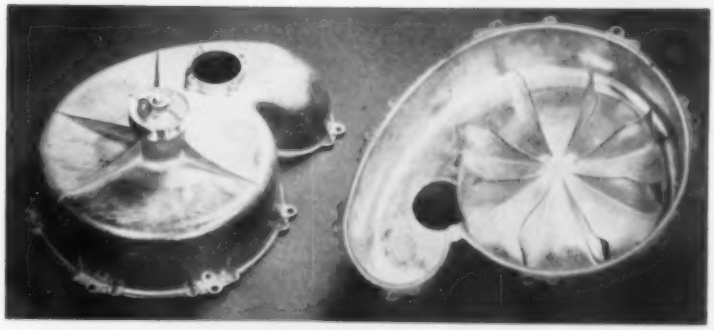
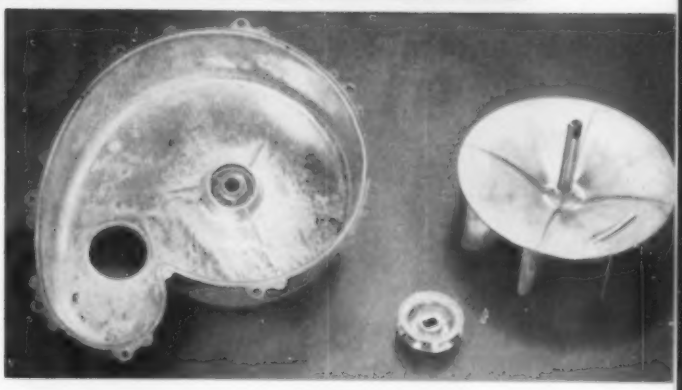


This blower is purchased from the die caster as a completely assembled unit Here is . . .



the case for Single Source Buying

Save money? More efficient? Faster delivery?

WHEN a product or sub-assembly is made up of a plurality of die castings, it is sometimes more economical to have a single vendor supply all castings, do the machining, and assemble the complete unit. When the jobbing die caster is not equipped to handle all phases of machining, plating or other secondary-operations, he can often assume the responsibility for these functions by sub-contracting them.

Buyers of die castings who have tried this system have reported seven special advantages: 1) There is no division of responsibility; 2) Inventories are held down; 3) Inspection loads are lightened; 4) Men and machines are freed for other work; 5) Minor tooling changes for faster assembly are easily made; 6) Packing and shipping costs are reduced; and 7) Major design changes are expedited.

An example of this type of die casting procurement is the blower assembly, above. This group of die castings and related parts is supplied by the vendor, Congress Drives Div. of the Tann Corp., as a complete assembly.

Division of Responsibility

Since only one vendor is involved in the transaction, the responsibility for required changes, any faulty material delivered, and meeting purchase specifications devolves onto a single vendor. There can be no "buck passing" . . . the part either meets or fails to meet the previously agreed upon enumeration of particulars.

Inventories

While the blower unit seems to consist of only three major die castings and a porous bronze bushing, there are, in addition, 13 or 14 other pieces that must be incorporated in the assembly and, of these pieces, at least nine are different. The advantages to be gained from stocking and maintaining inventories on one part as against a dozen is immediately apparent.

Inspections

Assuming that three different die casters and one source of supply of bushings are involved, there would be at least four initial inspections at the time the parts are received. The housing must be machined, requiring an inspection after machining.

In spite of the best efforts of the foundry, the fans will have to be balanced, another inspection. Finally, the entire unit is assembled and again inspected. When a single vendor undertakes to deliver a completed part, this final inspection is the only one

Continued next page

that the purchaser must make; thus a large inspection load is removed from the shoulders of the buyer.

Freeing Men and Machines

Some of the more obvious machining operations performed on this blower are: Ream the hole for the bushing and press the bushing in place; Drill and tap the mounting holes; Drill an oil hole (this must later be plugged after a supply of oil is put in); Make the drive shaft of the fan unit and balance the fan after casting and trimming; Machine the "Vee" groove in the pulley. Other minor machining may also be needed. All of these are done by the vendor so that the purchaser need not set-up to do the jobs. In addition, the construction and maintenance of jigs and fixtures is the vendor's problem.

This same saving in men and tools follows into the assembly. All of the small parts previously mentioned must be withdrawn from stock and fed to the proper stages along the assembly line. On the assembly line, small hand tools, some of them power actuated, are needed and, in addition, there is the constant materials handling problem. This is all eliminated in the buyer's plant when a complete assembly is purchased.

Minor Tooling Changes

While the overall design of the unit may be correct, minor changes may be needed to reduce machining and make assembly faster and easier. Where all of this is under the control of a single producer the desired changes are quickly made. Tolerances, within specifications, are held at the most desirable level for faster and easier assembly. With more than one vendor, the possibility of securing this nice balance in tool changes and tolerances would be more difficult to achieve. The most probable solution would be increased machining.

Packing and Shipping

Assuming, in this case, three major die casting sources, there must be three individual charges for packing, shipping and unpacking. While the total weight to be shipped is just about the same whether three parts or an assembly is shipped, in this case the entire assembly can be packed in about the same space as the housing alone, thus eliminating at least two packing charges.

Major Design Changes

When a major design change is to be made, it is by far the most desirable procedure to make these changes in consultation with the foundry that is to make the castings. When several vendors are involved, greater difficulty in getting agreement may be encountered.

It can be argued that all of these savings are fictional since the buyer must pay for them in one way or another. For a portion of them, this is true; a few are directly translatable into cost reduction, an example being the lowered packing, shipping and unpacking costs.

Other savings are less easily recognized. Inspection is seldom charged directly, but is an overhead item. If fewer inspectors

Continued on page 86

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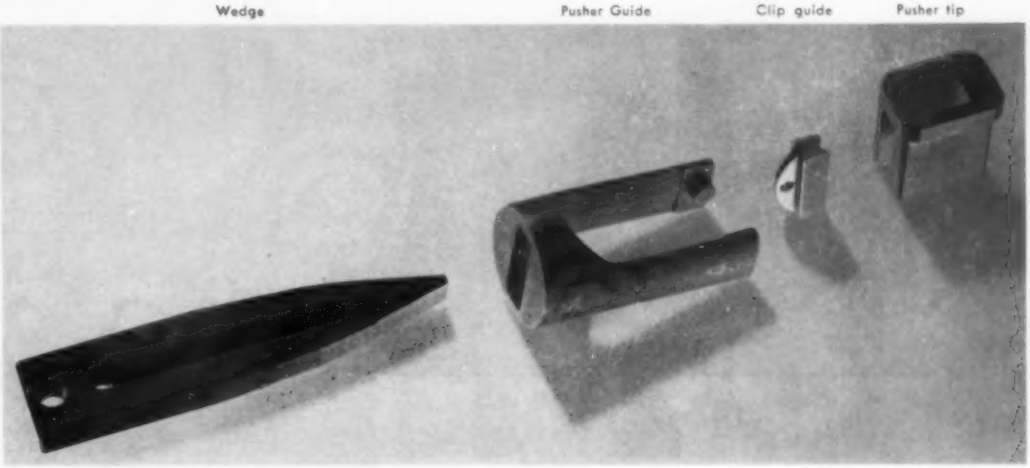
How four investment castings are heat treated . . .



PART NAME	STEEL (SAE)	HEAT TREATMENT	FINAL HARDNESS Case	Core
Wedge	4620	Normalize at 1800 F; case carburized wedge edges only, 0.035 deep; harden.	58-62 R.	33-37 R.
Pusher Guide	8640	Normalize at 1700 F, marquench from 1550-1575 F into salt at 400 F; temper at 450 F.	45-50 R.	
Clip Guide	4615	Normalize, case carburize 0.015 deep; oil quench from 1425 F.	58-60 R.	25-30 R.
Pusher Tip	4615	Normalize, case carburize 0.030 deep; oil quench from 1550 F; temper at 800 F.	42-46 R.	

Required: Ability To Stand Wear And Impact

WHERE the design of a tool calls for components that must resist both wear and impact, a hardenable steel part is required. Couple these requirements with a necessary or desirable shape that is expensive to machine and the usual answer is investment casting or forging.

Where quantities allow, an investment casting will generally give a part that is more nearly finished, has a better surface, and can be cast as a more complex unit. In most cases, the cast structure can be sufficiently modified by normalizing so that the peculiar advantages of a forged structure becomes of minor importance.

For at least four of the parts used in the clip squeezer, made by the Rotor Tool Co., investment castings in three different steels, cast by The Crucible Steel Co. of America, have been found to be the best and most economical. These four castings are illustrated.

This tool takes a clip from a magazine, bends it around a group of two or more spring wires and finally delivers a squeeze to crimp the clip in place. To perform these functions on assembly line manufacturing requires a tool of exceptional stamina. A further requirement of the tool is that it must be adaptable to a wide range of wire sizes if it is to be of widest applicability.

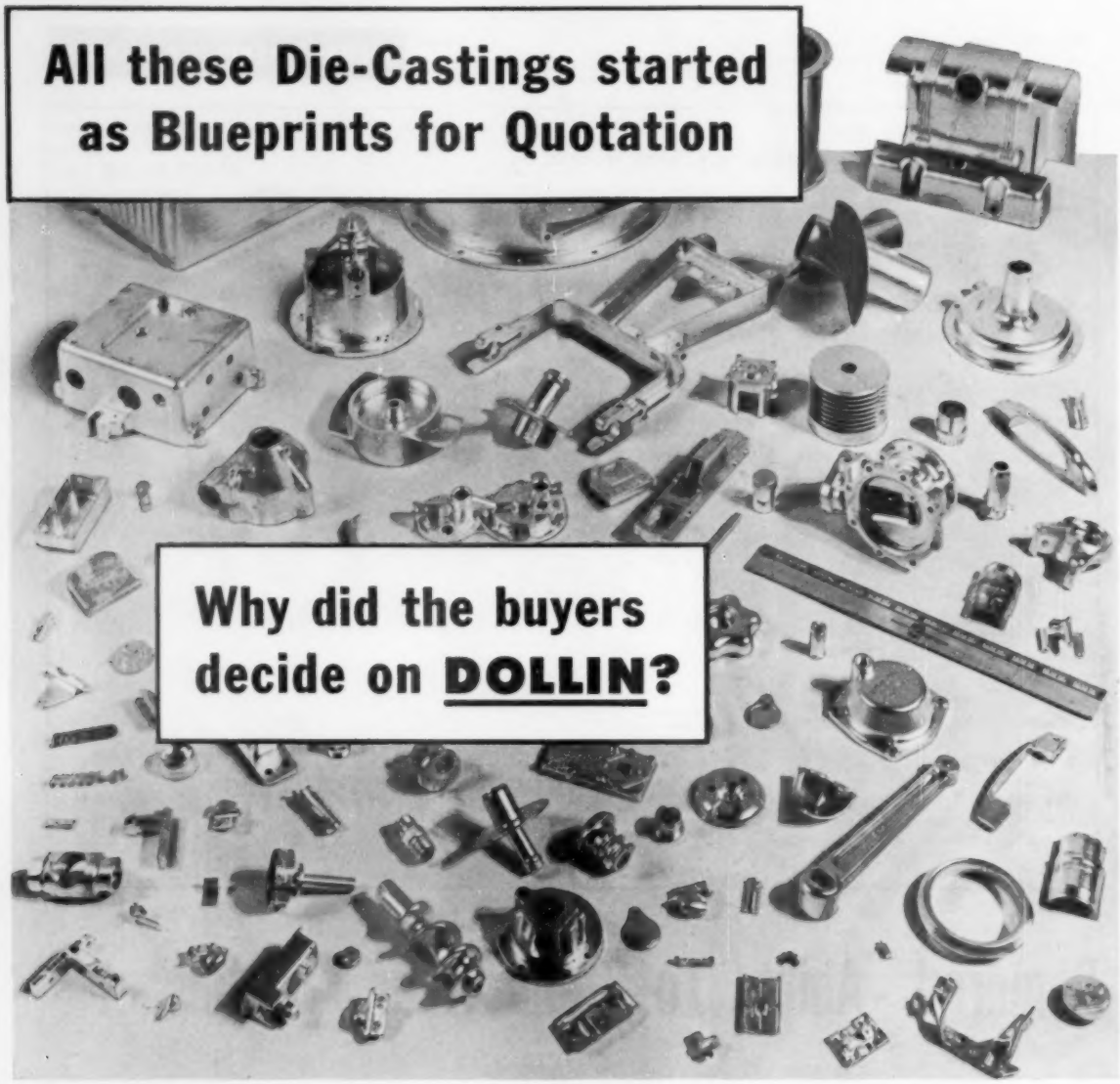
A further complicating factor, as far as the four investment castings are concerned, is that all of them are subject to high wear and three of them to impact also.

Because the finished dimensional tolerances are far closer than even investment casting can produce, it is standard practice to leave about 0.010 for finishing stock. Where dimensional accuracy within normal foundry practice is adequate the parts are, of course, cast to size.

By the proper attention to design, it has been possible to cast these parts so that finishing is limited to simple operations such as grinding, drilling, etc.

As noted above, the parts are subject to both wear and impact; heat treatment is, therefore, imperative. The type of steel, heat treatment and final hardness of each of the parts is given in the table above.

All these Die-Castings started as Blueprints for Quotation



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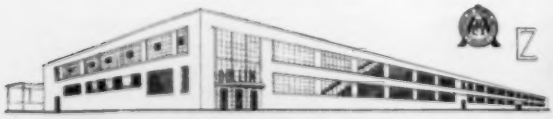

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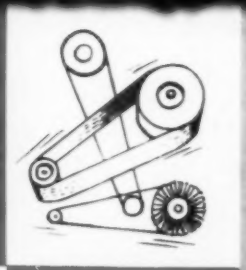
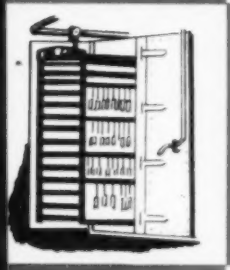

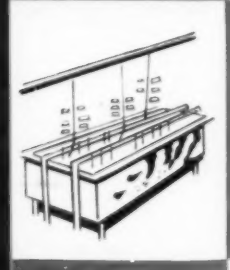

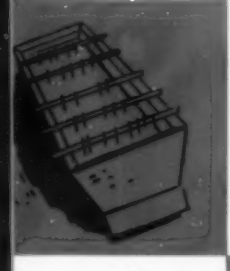

PMM

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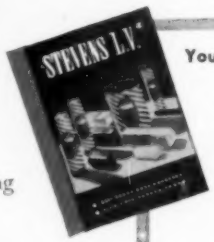

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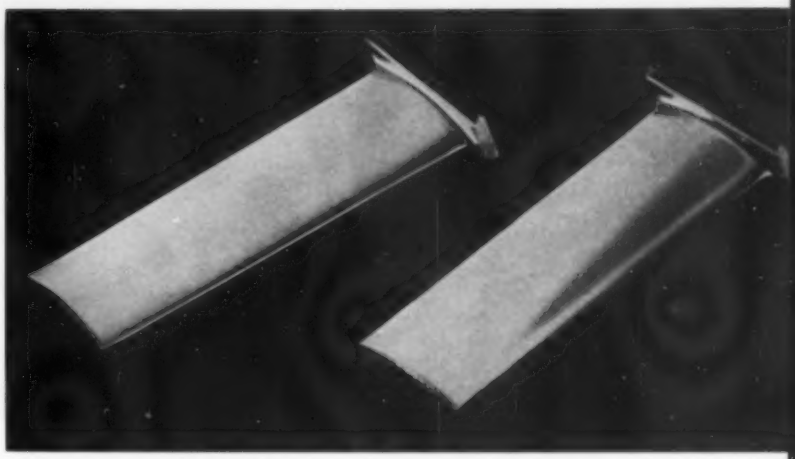
a PMM photo story



NOT FOR BEAUTY, the finish on these jet compressor blades meets an important functional requirement. Here's the method they use at Thompson Products to . . .

Finish Compressor Blades To 6-8 Micro-Inches

Precision is the keynote to every phase of this finishing operation

THE manufacture of compressor blades for jet engines by powder metallurgical processes has become well established. The process employed by Thompson Products, Inc. is typical of that generally used to meet critical surface finish specifications. However, much of the equipment used at Thompson is specially built for the purpose.

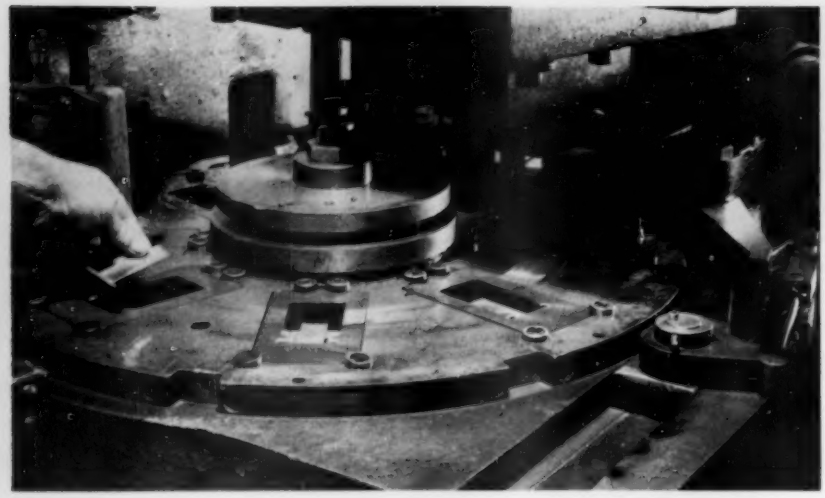
The blade is pressed from a mixture of iron and copper powders with a small amount of Sterotex added as a die and powder lubricant. In this initial pressing, about 30 tsi are used. The blades are then sintered in dissociated ammonia at 1900 F for two hours. In this initial pressing and sintering, the blade is formed to size and shape, but does not achieve final density or strength nor has it the slight twist that is needed for proper directional effect.

Following the sintering, the blade is lightly coined and then infiltrated with copper. In this latter step, a formed copper slug, also pressed from powder, is placed on the base of the blade which is held vertically, in specially designed furnace racks. The infiltration is done at 2050 F and requires about four hours at temperature; here again, a dissociated ammonia atmosphere is used.

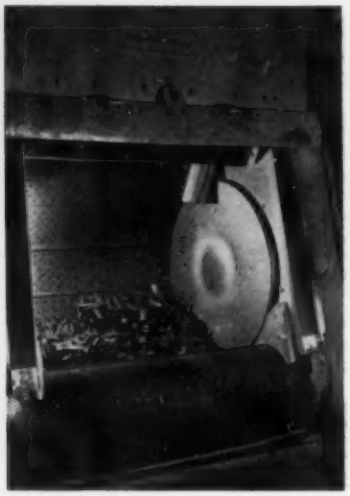
After infiltration, the blade is coined to achieve the size and shape required. In this condition, the blade is relatively soft and must be heat treated. Since an iron-copper alloy responds readily to precipitation heat treatment, that method is used. The blades are heated to 1650 F, held for one hour and water quenched. The solution treatment is followed by aging for 45 minutes at 850 F and then cooling. This hardening gives a blade of 90 Rockwell B.

During the heat treatment, there is some warpage of the blade and the surface is relatively rough (rough, that is, for the intended use). At this stage of manufacture, the actual surface finishing operations start.

Now they're ready for finishing



1. INDEXING TABLE, mounted in hydraulic press, removes any warpage from prior heat treatment and corrects twist of blade with respect to base. Interlock brings new blade under ram at each press stroke. After this operation, blades go to the degreaser.



2. BLAST CLEANING with cast iron dust removes oxide scale, deburrs, and starts the polishing operation. Airless blast machine is used.

Here is the finishing cycle for a sintered blade

19 steps from powder to finished blade

1. Press at about 30 tsi.
2. Sinter at 1900 F, 2 hours.
3. Coin
4. Infiltrate with copper at 2050 F.
5. Coin
6. Harden to 90 RB.
7. Straighten
8. Degrease
9. Blast Clean
10. First surface sanding
11. Grind to size
12. Blend leading and trailing edges.
13. Inspection
14. Broach
15. Deburr
16. Final polish
17. Chromium plate
18. Heat to remove hydrogen
19. Inspect and pack

The heat treated blade is given a final straightening and contouring to remove warpage from heat treatment and correct the twist of the blade with respect to the base. For this operation, a rotary indexing table is used that is mounted in a hydraulic press, Figure 1. Table motion is interlocked with the press so that a new blade is brought into position for each press stroke. A good grade of oil is used as a lubricant in this operation and before surface finishing operations, must be removed.

Following degreasing, the blades go to an airless blast cleaner, Figure 2, using cast iron dust as the media. This operation removes gross scale and oxides and, at the same time, deburrs and starts the polishing operation. This operation produces a relatively coarse surface so that the blades must then go to the rough sanding machine, Figure 3.

This automatic surface finisher uses abrasive paper strip, held stationary while the blade is oscillated vertically between contour blocks. Feed of the abrasive strip is automatic and in one complete revolution of the machine fresh abrasive strip is fed in twice. The rough polishing gives a surface finish of about 20 microinches RMS. The blade, at this stage may not be exact size.

It goes, then, to a grinding unit, Figure 4, where it is held in a jig and ground to exact size. The last two operations, while they have put a fair surface on the blades, have left some sharp corners. Since gas flow over the blades would be impeded and misdirected by these corners, the blades then go to a belt sander, Figure 5 where the leading and trailing edges are blended into the curve of the blade surfaces.

Except for such inspection as occurred during the forming and infiltration, there has been no rigorous inspection up to this point. The blades now go to Zyglo, X-ray and visual inspection. All those blades without rejectable defects, but which have not met surface inspection standards, are marked and hand polished to produce a surface sufficiently smooth for final polishing.

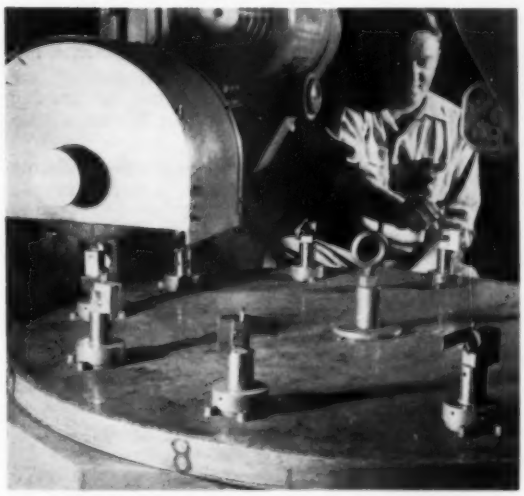
Thus far in the manufacture, the base of the blade has not been given any finishing treatments. It is therefore broached to fit and hold in the mountings provided.

Broaching creates burrs on the cut edges and these must be re-

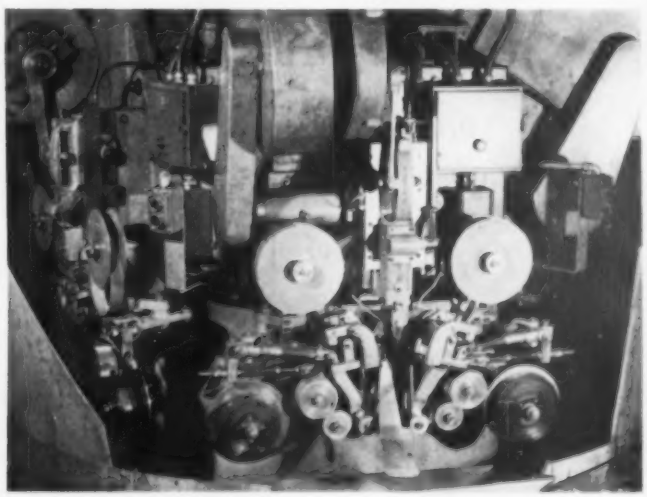
3. ROUGH SANDING to about 20 micro-inches rms is done with abrasive paper strips fed automatically from two reels. Blade oscillates between contour blocks.

4. GRINDER reduces blades to exact size, giving fair surface, but leaving sharp corners that might impede smooth flow of gases across the surface.

5. BELT SANDER blends leading and trailing edges into curve of the blade surface, and they are then ready for Zyglo, X-ray and visual inspection.



6. WIRE BRUSH DEBURRING machine follows broaching of the blade bases. This removes burrs. Two operators reverse blades so that both ends of the base get deburred.



7. FINAL POLISHING on a machine similar to rough polisher, uses strip abrasive with much finer grit. When blades complete one revolution, they have a 6-8 microinch finish.

moved in the wire brush deburring machine, Figure 6. Since burrs occur on both ends, the machine uses two operators, one to load and unload and the other one to reverse the blades before they pass under the second wire brush.

Now the blades are ready for the final polishing done on a machine, Figure 7, similar to the one first used for the rough polishing. Here the strip abrasive is much finer grit than before so that when the blades have made one complete revolution of the table, the faces have been polished to from 6 to 8 microinch finish.

Final step is chromium plating in a fully automatic plating unit, Figure 8. As in every plating operation, the manner of racking is an important factor in the quality of the finished job. When in full

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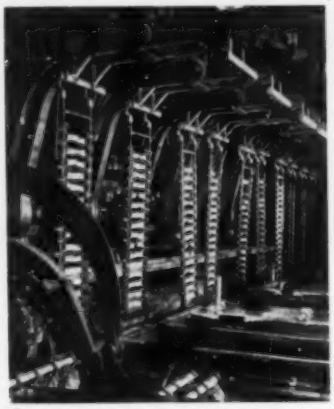
production, the plating unit holds two loaded racks per station. A full circuit of the tank requires one hour and 50 minutes, 2.75 minutes per station with a 6 second life and 25 second traverse. The complete plating cycle is outlined below. The plating current density varies somewhat, but is about 20 amps. per square foot while the electrolytic cleaning is done at about 50 amps. per square foot.



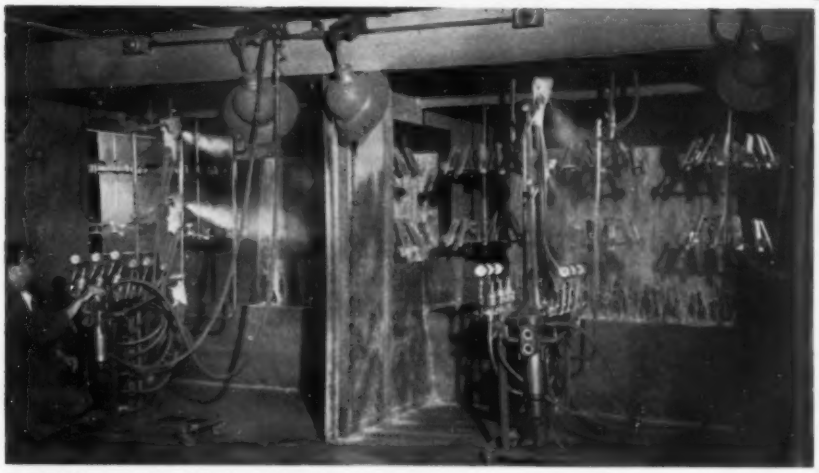
8. RACKED BLADES being plated in a fully automatic machine. All cleaning, rinsing and plating operations are properly sequenced. Machine can handle two racks per tank if needed.

Following the complete plating cycle, the dissolved and entrapped hydrogen must be removed to prevent embrittlement of the plate. This is done by baking the blades for two hours at 500 F in air. The finished blades are then ready for final inspection and packing.

Plating jet blades takes 1 hour and 50 minutes

1. Rack
2. Clean, hot alkali, electrolytic using about 50 amps per sq. foot at 6 volts
3. Cold water rinse
4. Hydrochloric acid dip
5. Cold water rinse
6. Clean, hot alkali (same as above)
7.-8. Wash (two stations)
9. Copper plate, one station, two min., 45 sec. in bath, 0.00005" tck. plate
10. Cold water rinse
11. Acid dip
12.-25. Nickel plate, 13 stations, 32 min., 0.0004 tck. plate.
26.-27. Cold water rinse, two stations
28. Acid dip
29.-30. Chromium plate, 2 stations, 5 min., hard chromium 0.00003 in. tck. plate
31. Spray wash
32. Dip wash, hot water
33. Dry

Total cycle 1 hour, 50 min.
Bake 2 hours at 500 F to remove hydrogen in plate.
Plating done at 20 amps per sq. ft. about 2 volts.



ELECTROSTATIC PAINT SPRAY units apply two coats of paint to stapler parts. Direction of rotation is reversed between the two stations for more uniform coverage.

105 Minutes -- Total Cycle

77 Minutes -- Actual Finishing

28 Minutes -- Transfer Time

Electrostatic Paint Spray For Automatic Finishing

by **IRVING FELDMAN,**
Plant Superintendent
Speed Products Co.

DESIGNED to handle either steel stampings or zinc base die castings interchangeably, the finishing system installed at Swingline Speed Products Co., embodies many of the latest developments in finishing procedures.

The basic premise on which the entire finishing system was designed was maximum flexibility. Many of the staplers made by this company are impulse buying items; hence color becomes important. It follows then that the manufacturer must be able to meet this demand easily and with minimum change-over cost. Naturally, the demands for different colors requires that the finish be paint.

Other than the color requirement, the finish must be extremely durable. Staplers are subject to considerable abuse and a painted finish that would chip or crack when the unit is dropped cannot be tolerated. The requirement is, then, for a highly flexible finish coat that is very firmly bonded to the base metal. The bonding requirement is further complicated by the originally stated requirement that it must be used interchangeably on steel and zinc alloy with no process changes.

The system now in use meets all of the requirements. It was designed and installed by the Despatch Oven Co. and incorporates, in a closed circuit, cleaning, surface preparation, drying, spray painting and baking. Except for racking and unloading, the entire finishing operation is fully automatic and a complete cycle requires 105 minutes per rack.

Here's A Complete Cycle

To understand the finishing cycle, it will be well to follow a single rack through a complete cycle. Die cast stapler bases will be used as an example, but it should be remembered that steel parts could be handled as easily and, in fact, one rack can, if necessary, be loaded with both types of metal at the same time.

Racking

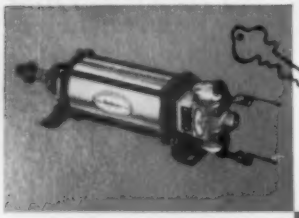
At the time that the bases are delivered to the finishing department, they are completely machined and ready for assembly. The racks hold 24 bases per load and are cylindrical so that they can be rotated about a vertical axis where that is necessary for proper treatment.

The method of racking is important: the parts must be held rigidly so that material sprayed on them will hit where it is wanted and, at the same time, leave no untreated areas where a finish is desired. The racks are carried on a Mono-rail type of conveyor that operates in a closed circuit so that both loading and unloading are done at the same station.

Cleaning

A loaded rack enters the finishing circuit and goes first to an

Use one or more of these "CONTROLLED-AIR-POWER" Devices to open the door to BETTER • SAFER • LOWER COST PRODUCTION

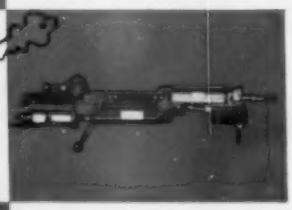


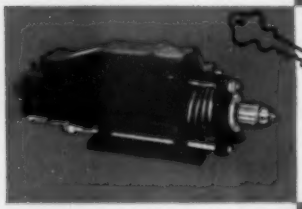
THE BELLOWS AIR MOTOR

The Bellows Air Motor is an integral power unit complete in itself. There are no extra valves to buy. Only one air connection is required. Integral construction means instant piston response to the valve. No lag — no delay. Built-in speed controls assure positive control of piston rod speeds in both directions.

DRILL PRESS FEED

Mounts on any standard drill press in 30 minutes. At a touch on the control lever the cutting tool rapidly advances to the work, moves through the work at correct rate and pressure, and automatically returns to starting position.



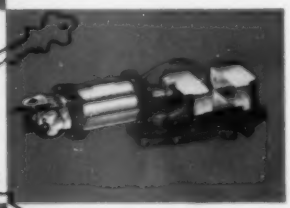


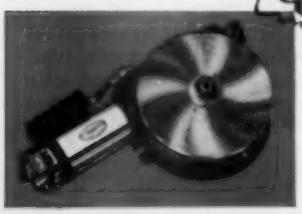
BELLOWS-LOCKE DRILL

A rugged, flexible unit combining electrically driven spindle with rapid, air-powered traverse and hydraulic feed control for peak efficiency drilling. Independent speed controls. Thrust equals 3 times applied air pressure. Stroke length adjusts 0" to 3".

AIR VISES

Flexible semi-automatic holding units to reduce costly "hand time". Light duty unit shown has 4" jaws, opens to 2¼", clamping pressures to 1000 lbs. Heavy duty vises available with clamping force up to 15,000 lbs.





ROTARY WORK FEEDERS

For fast, accurate feeding of work to tools. Work is done at one or more stations as operator loads and unloads at another. Inter-cycle idle machine time reduced 50% or more. All models include built-in speed controls, impulse switch for interlock to other machine elements.

As competition increases in the Metalworking Industry, cost-wise shop men throughout the country are using "Controlled-Air-Power" to help beat the cost problem. Bellows "packaged" controlled-air-power devices are highly flexible work units designed for holding work, feeding work to tools, or tools to work . . . faster . . . safer . . . better . . . and at lower cost. These packaged Work Units are easily interlocked to form low-cost tool-room-built special purpose machines in which several operations can be combined into one.

The heart of these Packaged Work Units is the Bellows Air Motor—the air cylinder with built-in valve and speed controls. A versatile precision work unit complete in itself, the Bellows Air Motor can help cut costs in your shop. Send for additional information.

Write for Bulletin CL-50, address The Bellows Co., Akron 9, Ohio, Dept. PMM 655.

HAVE YOU SEEN "OPERATION PUSHBUTTON"?

This new Bellows sound movie shows "Controlled-Air-Power" in actual use in all types of industry including metalworking. See and hear amazing cost saving stories from all over the U. S. A. and Canada. Your Bellows Field Engineer will arrange a showing. You'll find it well worth your time.

The Bellows Co.

Akron 9, Ohio

1136A

CONTROLLED-AIR-POWER FOR FASTER, SAFER, BETTER PRODUCTION

For more information circle No. 72 on the Reader Service Card

alkali wash. Here a mild alkaline detergent removes all oil, grease and other soil from the surface. From the wash, the parts go through a hot water wash and rinse, using spray to insure the complete removal of all alkali and loose surface soil.

This is the first step where the cylindrical rotatable racks show an advantage. Because the racks can be rotated, every part of the bases being treated is subjected to the spray wash. If flat racks were used, a complex array of nozzles would be required to secure the necessary rinsing action.

Phosphate Coating

The rinsed parts then pass into a phosphate treating section where No. 160 Bonderite is used. The choice of this chemical conversion coating is based upon its ability to give the desired surface condition to both zinc and steel with no changes in either material, temperature or timing. The parts are then spray rinsed with hot water.

Stabilizing

To give stability to the paint base and the required adhesion, the surface of the metal must be "fixed". Here a dilute chromic acid rinse (Parkolene) is used.

The five steps in the finishing process from the wash through the fixing require a total elapsed time of 12 minutes.

Drying

Prior to spray painting, the parts must be dried. The racks still on the conveyor pass into a drying oven where the last traces of surface moisture are removed. This drying time is 22 minutes, but this does not include a short period for transfer from the Bonderizing section to the first drying oven.

Electrostatic Painting

When the parts emerge from the drying, they are ready for spray painting. For this step, a two-pass Ashdee electrostatic paint spray system is used with both stations in a 16 foot water wash booth. As the racks pass through the spray booth, they are rotated in a clockwise direction in the first spray station. Here a light coat of urea-formaldehyde base paint is applied over all areas of the stapler parts.

A few feet farther along the line is the second spray station. Here the final coat of paint is applied. The direction of rotation of the racks is reversed to counter-clockwise; this provides good coverage and excellent uniformity of paint film. The operations are entirely automatic and coverage is so good that no touch-up is required.

Each spray station consists of two or three automatic spray guns of the air-atomizing type. The guns are positioned approximately 24 inches from the parts being painted. A U-type ionizing electrode is mounted half-way between the spray guns and the product moving past on the conveyors. The ionizing electrode is at a potential of 100,000 volts above ground and is powered by a four-tube transformer rectifier unit.

Paint spray is directed through the center of the electrode at the product. The paint particles pick-up a negative charge in the electrostatic field set up by the ionizing electrode, and are attracted to the grounded metal product on the conveyor. The electrostatic field causes paint to collect on all areas of the stapler parts, minimizing overspray and paint waste.

Continued next page

ROTO FINISH
your new opportunity in
controlled precision finishing
Roto-Finish processes are controlled precision finishing operations using low cost mass production techniques, which maintain exact tolerances on most any size or shape precision part with no significant dimensional changes. Roto-Finish speeds production, cuts maintenance expense, minimizes operational costs, yet produces top quality finishing results. Roto-Finish offers latest in controlled methods, materials and special purpose fixture equipment. Roto-Finish is your new opportunity in controlled precision finishing with guaranteed results!
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Phone 3-5578

visit our booth | No. 394 at Industrial Finishing Exposition, June 20-23 at Cleveland Public Auditorium

For more information circle No. 68 on the Reader Service Card

ELECTROSTATIC SPRAY—cont.

With this system, the spray guns and the work are at ground potential so that metallic pigmented paints can be successfully sprayed and any minor adjustments can be made while the system is in operation.

The time required for actual spraying is only three minutes for the parts to pass both stations.

Paint Baking

Following the spray painting, the parts go into a baking oven where the paint is fully cured in 40 minutes.

The total time for the entire cycle is 105 minutes, of which 77 are employed in actual treatment (including drying and baking) while the balance, or 28 minutes, is utilized in transfer from station to station.

Despite the electrostatic spray units, there is some overspray since the interchanging of parts to be finished will not allow as fine an adjustment of the spray as might be achieved if only one type and shape of part were being handled. For this reason, it is necessary to filter the water continually as it is recirculated in the spray booth. The collected overspray is collected daily.

ABRASIVE BELT MACHINERY MARKETED NATIONALLY

A nation-wide sales force for the Engelberg Huller Company's abrasive-belt machinery division has just been completed, according to John T. Schenck, president of the Syracuse, New York firm. Nine sales engineers, each covering a regional territory, will be responsible for division sales and service assignments.

Engelberg Huller acquired the abrasive-belt machine division of the Porter Cable Machine Company in 1953. Since that time, the standard lines of abrasive-belt machine has been improved, Mr. Schenck said, with other grinder equipment currently being designed and tested for introduction later this year.

Mr. Schenck has named the following men to territorial assignments: Cecil E. Gordon, southwestern territory; Charles Vergan, central territory; Glenn D. Swander, southeastern territory; J. D. Kraeger, west coast territory; Earl Whitt, mid-Atlantic territory; Howard Miller, east central territory; and Charles Murphy, northeastern territory. David Turner will act as an Engelberg Huller agent in the company's west central territory and Harvey Ramsay will act in the same capacity in the Canadian territory.

LIMA COMPANY EXPANDS

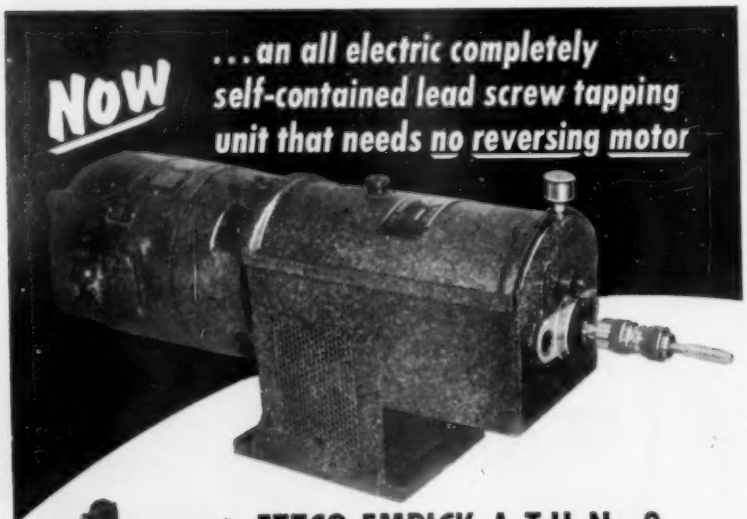
The Lima Electric Motor Co. is expanding its main manufacturing plant at Lima, Ohio and increasing its production facilities there. H. E. Reeder, president of the firm, has announced that construction is underway and is scheduled for completion in approximately three months.

RESEARCH FACILITIES OPENED

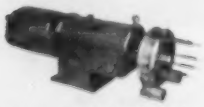
To introduce its new research and development facilities, Metals Disintegrating Co., Inc. of Elizabeth, N.J. held an open house for the technical and trade press on May 4. The four major divisions of the laboratories were discussed by the following: Julius Sachse, Metal Abrasive Div.; David C. Bradley, metallurgical powders; Dr. Alex F. Knoll, metallic pigments; and John B. Haertlein, the field of particle size analysis.

ADDRESS CORRECTION

Due to an error in proof reading, the address for the ABC Die Casting Machine Company was incorrectly listed on page 115 in the May issue of PMM. The Company's correct address is: Dolton, Illinois.



The ultimate in tapping speed and economy. A.T.U. No. 3 Lead Screw Tapping Machine with Ettco-Emrick multiple spindle head and work holding fixture.



A.T.U. No. 3 Lead Screw Tapping Unit with Ettco-Emrick multiple tapping head.

New **ETTCO-EMRICK A.T.U. No. 3**

with forward and reverse electric clutches

Fastest, most accurate and simplest method of lead screw tapping yet devised! Utilizes instantaneous-acting forward and reverse electromagnetic clutches to make tapping easy and automatic. Check these features:

1. All-electric operation and control.
2. No reversing motor required — electromagnetic clutches control tap direction.
3. Built-in rheostat control permits torque of clutches to be adjusted over a range of from 0 to equivalent of 2 hp.
4. Thread depth control to within ¼ turn of tap.
5. Readily interchangeable lead screws and nuts.
6. Operates in any position—horizontal, vertical or at any angle.

The A.T.U. No. 3 Lead Screw Tapping Unit can be incorporated into a limitless variety of tapping setups using Ettco-Emrick fixed or adjustable spindle multiple heads, work holding fixtures, etc.

Bulletin No. A.T.U. has details. Send for a copy.

ETTCO TOOL CO., INC.

506 JOHNSON AVE., BROOKLYN 37, N. Y.

Chicago • Detroit • Menlo Park, Calif. • Worcester

Distributors throughout the U.S. and Canada

TAPPING ATTACHMENTS • MULTIPLE HEADS • TAPPING MACHINES • INDEXING FIXTURES • TAP AND DRILL CHUCKS

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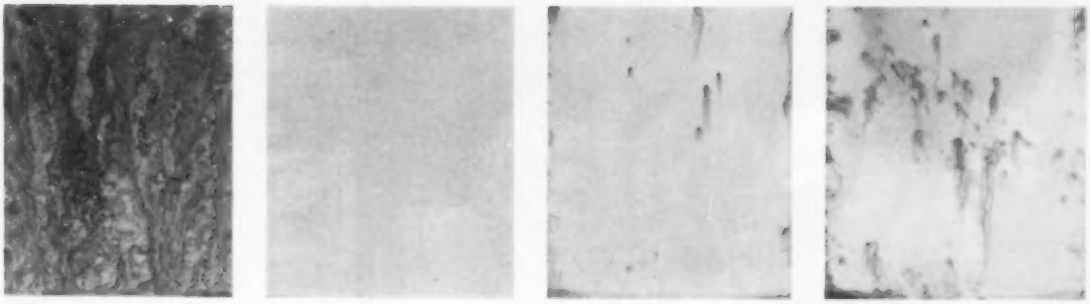
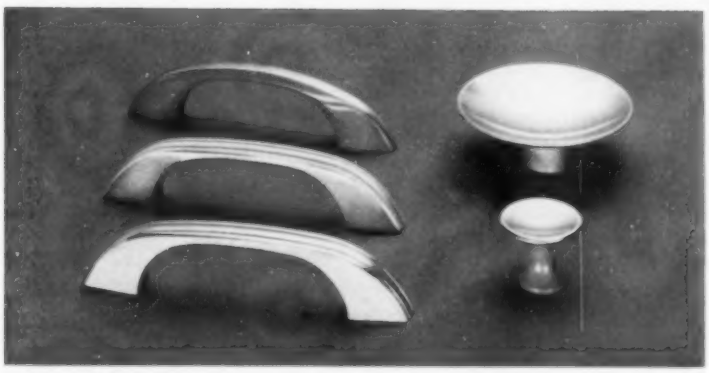
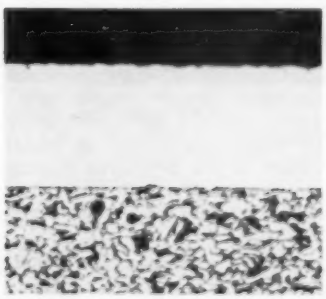


SALT SPRAY RESULTS with chromium directly on steel, plating thickness 0.0003. (L to R) Conventional chromium 24 hours exposure; Crack Free 24 hours exposure; Crack Free 100 hours; Crack Free 175 hours.

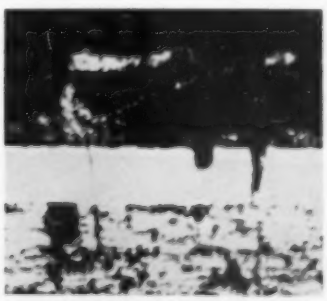
Chromium Without Microporosity Plated Directly Onto Base Metal



COMBINATION FINISHES are obtained on die cast zinc cabinet hardware by selective buffing of the matte type deposit of Crack Free chromium. Various combinations of buffed and unbuffed surfaces have been used. Some surfaces, such as the side of the casting top left, are unbuffed but lacquered.



DENSE CONTINUOUS structure of the Crack Free deposit (center band) is illustrated in this cross section.



CRACKS THROUGH THE CHROMIUM deposit can be seen in cross section (center band) in which conventional process was employed.

USERS of chromium plated metal products have had to contend with the porosity and microscopic surface cracks that are characteristic of conventional electrodeposited chromium coatings. Most successful method of preventing penetration of moisture and other corrosive materials through the coating has been the use of undercoatings of copper and nickel.

Now a plating process has been introduced that permits the deposit of a dense, non-porous layer of chromium directly onto the base metal, such as die cast alloys, steels, copper, etc. The continuous structure of the deposit, called Crack-Free chromium by United Chromium, Inc., who developed it, is reported to give ample protection without the need for undercoatings.

Properties claimed for the crack-free deposit include:

1. Much better corrosion resistance than ordinary chromium plated directly on steel.
2. Remains crack-free when heated to 1000 F and plunged into water.
3. Softer and more ductile than ordinary chromium (500-700 Knoop as compared to 800-1000 Knoop hardness).
4. Excellent adhesion.
5. Improved non-galling, non-seizing and leveling properties.

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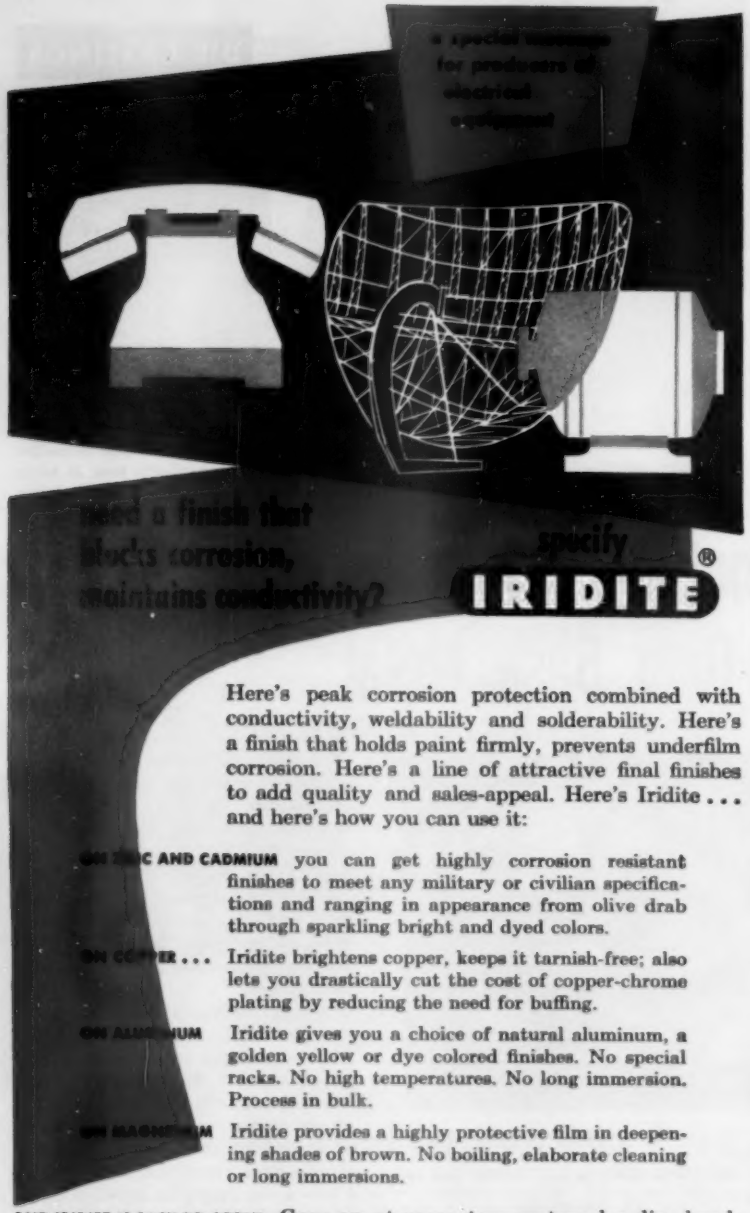

Here's peak corrosion protection combined with conductivity, weldability and solderability. Here's a finish that holds paint firmly, prevents underfilm corrosion. Here's a line of attractive final finishes to add quality and sales-appeal. Here's Iridite . . . and here's how you can use it:

ON ZINC AND CADMIUM you can get highly corrosion resistant finishes to meet any military or civilian specifications and ranging in appearance from olive drab through sparkling bright and dyed colors.

ON COPPER . . . Iridite brightens copper, keeps it tarnish-free; also lets you drastically cut the cost of copper-chrome plating by reducing the need for buffing.

ON ALUMINUM Iridite gives you a choice of natural aluminum, a golden yellow or dye colored finishes. No special racks. No high temperatures. No long immersion. Process in bulk.

ON MAGNESIUM Iridite provides a highly protective film in deepening shades of brown. No boiling, elaborate cleaning or long immersions.

AND IRIDITE IS EASY TO APPLY. Goes on at room temperature by dip, brush or spray. No electrolysis. No special equipment. No exhausts. No specially trained operators. Single dip for basic coatings. Double dip for dye colors. The protective Iridite coating is not a superimposed film, cannot flake, chip or peel.

WANT TO KNOW MORE? We'll gladly treat samples or send you complete data. Write direct or call in your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified telephone book.

Iridite is approved under government specifications

ALLIED RESEARCH PRODUCTS
INCORPORATED
4004-06 E. MONUMENT STREET • BALTIMORE 5, MD.

Manufacturers of Iridite Finishes for Corrosion Protection and Paint Systems on Non-Ferrous Metals, ARP Plating Chemicals.
WEST COAST LICENSEE: L. H. Butcher Co.

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Direct Chrome Plate—cont.

6. Same protection as obtained with composite copper-nickel-chromium decorative finishes.

The plate is deposited as a uniform light gray matte that can readily be color buffed to a high luster.

The group of zinc die castings, page 67, illustrates the decorative effects possible using combinations of buffed and unbuffed areas for contrast. One major producer of cabinet hardware is now utilizing crack-free deposits 0.3 mil thick directly over die cast zinc.

Ordinary chromium deposits more than .0001 thick show cracks which permit corrosive agents to reach the underlying metal. At the decorative thickness, conventional chromium deposits contain pores, varying in number with plating conditions.

As the deposit thickness increases, the number of pores decreases but a cracked structure develops and continues regardless of the increase in thickness. Corrosive media can filter through these openings to attack the base metal. The new method of plating is designed to overcome this.

This process uses a special chromic acid type bath having automatic regulation of catalyst concentration. Standard plating equipment and procedures are used, although temperature control is critical: temperature must be held at 150 F $\pm$1 degree.

The bath is prepared by dissolving a proprietary compound in water, and the same compound is used for maintenance. Plating speed is about the same as for regular type chromium.

The Maytag Company of Newton, Ia., recently put into operation an automatic plating machine to plate the crack-free type of chromium directly on steel shafts. The company reports that although shafts chromium plated with one-half mil of conventional chromium deposit were completely covered with rust after 100 hours salt spray, an equal deposit of the new type plating was practically unaffected when exposed to the same conditions.

Leveling characteristics of the new-type deposit are also noted. Washing machine shafts that initially had 30 to 50 micro-inch finish had a three to seven micro-inch surface after applying 0.3 to 0.4 mils of chromium plate.

USEFUL LITERATURE CATALOGS, MANUALS

to get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

PROCESSES

Powder Metallurgy Explained: 144
Two brochures and a reprint that explain and graphically demonstrate the powder metallurgical processes are being distributed by the Hoeganaes Sponge Iron Corp.

Powder Metallurgy Manual: 145
An all-new, 48 page engineering manual has been published by the Amplex Div. of Chrysler Corp. Much of the basic design information needed by engineers to apply powder metal parts is contained in this manual.

Applications of Investment Casting: 146
In a four page brochure, the Scott Casting & Mfg. Co. gives a number of case histories showing how expensive machined parts were converted to investment castings. Dollar savings for several of the conversions are given.

Stainless Steel Castings: 147
The Crucible Steel Co. of America has issued a comprehensive 19 page booklet on the investment casting process. Data on castable alloys, physical, mechanical and chemical properties are given as well as typical applications.

Die Casting Bulletin: 148
A multi-color brochure has been issued by the Grand Rapids Brass Co. Div., of Crampton Mfg. Co. giving information on the die casting process, examples of the products made by the company and a brief description of the design, manufacturing and finishing facilities available.

Castings in Plaster Molds: 149
A brochure has been issued by Morris Bean & Co. that describes the Antioch Process for making aluminum precision castings. Examples of castings made, some of them very large, are given.

Non-ferrous Permanent Mold Castings: 150
A new brochure has been issued by the B-Mold Div. of Buckeye Brass & Mfg. Co. describing their permanent mold facilities. The folder contains an analysis and comparison of permanent mold castings compared with all other methods of casting and forging non-ferrous metals. Typical applications and an alloy chart are included.

MATERIALS AND EQUIPMENT

Stainless Steel Wire: 153
A 32 page catalog on the selection of fine stainless steel wire for any particular purpose is available from the Crucible Steel Co. of America.

Aluminum Fluxes: 154
A file folder on fluxes for melting aluminum has been issued by Apex Smelting Co. The file contains material on the use of fluxes, the proper selection of fluxes and other pertinent data.

Non-ferrous Melting Furnaces: 155
In a 19 page catalog (bulletin no. 900) the Stroman Furnace & Engineering Co. has listed the physical and operational data of a wide range of furnaces made by the company.

Powdered Metal Tools: 156
A 35 page booklet published by Cleveland Tool & Die Co. describes the many types of tools and dies regularly made by them. Included are examples of simple and complex tooling that has been made for compacting metal powders.

Pyrometry Equipment: 157
The Peerless Electric Co. has issued a brochure describing its Thermocouple Restorer, a device for rewelding and correcting broken or off-calibration thermocouples. Some auxiliary equipment is also described.

Radial Drill: 158
A new radial drill embodying some 18 points of superiority is described in a multi-color brochure that has been published by Cincinnati Lathe & Tool Co.

Carbide Tooling: 159
An informative catalog on carbide tooling has been issued by Allegheny Ludlum Steel Corp. Included are data on grade selection, brazing, grinding, etc. as well as tables of recommended machining practice for a wide variety of different materials.

Meehanite Casting Chart: 160
A wall chart containing the complete design and engineering properties of the various types of Meehanite castings available has been prepared by the Meehanite Metal Corp.

Graphite Coatings: 161
A fully revised six page catalog (Bulletin No. 435), entitled "Colloidal Graphite for Surface Coatings and Impregnation" has been published by Acheson Colloids Co.

Piston & Sealing Rings: 162
Precision Piston Rings, Inc. has issued a bulletin giving the physical and mechanical data on piston rings for industrial applications. Data on eight different alloy compositions are given.

Vacuum Furnaces: 163
Featuring a new 50 lb. skull type vacuum furnace, the latest catalog of Naresco Equipment Co. describes and illustrates the full line of vacuum furnaces and associated equipment sold by that company.

Alloy Selection Chart: 164
"A Selection Guide to Corrosion Resistant Cast Alloys" has been made available from the Alloy Casting Institute. The guide is designed to help engineers select the best cast alloy for both corrosion and mechanical requirements.

Molybdenum: 165
An informative booklet on molybdenum has just been published by Sylvania Electric Products, Inc. Processing, properties, forms available and critical data are presented.

Vacuum Pumps: 166
A set of data sheets describing a line of booster pumps from 4" to 16" has been issued by the F. J. Stokes Machine Co. Pressures from 10 to 500 microns can be achieved with the pumps at high rates of efficiency.

Continued on next page

Can YOU Use It...

To Solve Your FINISHING PROBLEMS On Circular Die-Cast Parts?...

It's The NASH Automatic Multi-Spindle Flash Lathe

Frankly, **we don't know** if a machine like this would fit into your production picture. But it **is** performing a variety of finishing operations on plastic, rubber and steel parts. So there **could be** a place for it in the die-casting industry.

PERFORMS THESE ESSENTIAL OPERATIONS:

- **Removes Parting Line Flash**
- **Grooves Or Trims**
- **Abrades, Polishes or Buffs**
- **Crimping And Rolling**

A 10-Spindle Unit, with Variable R.P.M. on Spindles. Available in Two Models — Continuous or Intermittent.

SEND US one of your circular parts and we can immediately tell you if this machine is for **you!** Descriptive literature available.

J. M. NASH COMPANY

2357 N. 30th ST. **MILWAUKEE 8, WIS.**

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USEFUL LITERATURE — cont.

Temperature Control: **167**
A new bulletin, "Temperature Control Systems," is now available to anyone interested in the application of automatic control to industrial process applications. It is published by Wheelco Instruments Div. of Barber-Colman Co.

Super-Alloys: **168**
Detailed performance data on Allegheny Ludlum Steel Corp.'s superalloy A-286 is furnished in a new technical data folder recently published. The alloy is said to be highly resistant to heat and corrosion and have high strength up to 1300F.

Arc Melting: **169**
Bulletin No. 527 from Detroit Electric Furnace Co. describes a compact arc melting furnace. Melting time, power consumption, etc. for four different alloys are given.

Electroforming: **170**
The Bart Laboratories Co. has issued a bulletin on the production of intricate parts to a high degree of precision by the electroforming process.

Graphite Molds: **171**
A new and revised data bulletin has been issued by National Carbon Co. on graphite molds for both ferrous and non-ferrous metals.

Heat-Treating Ovens: **172**
Michigan Oven Co. has issued a new bulletin on heat treating ovens for aluminum, magnesium and titanium.

Nickel Powder: **173**
Data Sheets, PMS 72 and 73, have been published by Plastic Metals Div. of National Radiator Corp. They list the chemical and physical properties of the nickel powder made by that company.

Fluxes for Non-Ferrous Foundry Use: **143**
A descriptive brochure, specially for foundry superintendents and engineers charged with melting and pouring metal, has been issued by the Rossborough Supply Co. The action of fluxes and the most applicable material for any molten metal or alloy are discussed.

FINISHING

Diptank and Flowcoat Finishing: **176**
Two new bulletins have been prepared by the Du Pont Industrial Finishing Div. on diptank and flowcoat finishing. The advantages and disadvantages of the two methods are discussed and much technical information for setting up and using each method is given.

Adhesives, Coatings & Sealers: **177**
A new illustrated folder on the use of adhesives, coatings and sealers for joint-sealing, and bonding and protecting sheet metal in manufacturing and construction is available from Minnesota Mining & Mfg. Co.

Finishing Aluminum:
A new, 48 page, book, "Finishes for Alcoa Aluminum" demonstrates the wide range of colors that can be secured with aluminum. The book uses color photography to illustrate the various colors available and contains a brief description of how to achieve the various effects. Request copies from Aluminum Co. of America, 762 Alcoa Bldg., Pittsburgh 19, Pa. on your company letterhead.

Storing Coated Abrasives: **178**
Since the performance of coated abrasives depends to a large extent on the conditions under which the product is stored prior to use, the Coated Abrasives Div. of Armour & Co. has prepared a booklet, "How to Store Coated Abrasives."

Automatic Mask Washing: 179
A new booklet has been prepared by Conforming Matrix Corp. describing and illustrating the automatic mask washing machines made by that company. Savings in time and labor of from 35% to 50% are claimed for the machines.

Joining of Stainless Steels: 180
A 24 page booklet has been published by the Crucible Steel Co. of America on the welding, brazing and soldering of stainless steels. Seventeen methods of joining are discussed.

Caps & Plugs: 181
A brochure has just been released by Ray A. Scharer & Co. that describes and illustrates the Shurclose caps and plugs for sealing, protecting, masking, etc.

Rotary Table: 182
A new rotary table embodying a cross slide with an eight inch travel is described in a folder from Advance Products.

Cutting Tools: 183
A six page bulletin describes and illustrates the complete line of cutting tools made by the Detroit Reamer & Tool Co. Because the subland tools described are chosen on the basis of material to be cut, finish required, etc., this short treatise is of particular value.

Heat Treatment of Steel: 184
A 19 page booklet is available from Leeds & Northrup Co. which describes and illustrates homocarb furnaces and atmosphere generators. A thorough description of the homocarb method of heat treatment is also given.

Abrasive Belt Machining: 185
Machining through the use of abrasive belt machines is described and illustrated in a 23 page catalog that has been published by Engelbert Huller Co.

Continued on page 87

Machine de-burring with NOBUR pays BIG production dividends!

NOBUR Tools *turn a slow bench operation into fast and efficient machine work!* Remove burrs on multi-walled parts with a smooth, clean cutting action that won't mar highly finished surfaces. Eliminate rejects from slow, costly hand work with files, scrapers and abrasives.

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Nobur Tools cut freely on either hard or soft metals, are simple in construction and are made in sizes to cover a full range of hole diameters. ***NEW "DS" SERIES extends range of NOBUR applications to holes as small as 1/8" diameter. WRITE FOR FULL DETAILS TODAY!**

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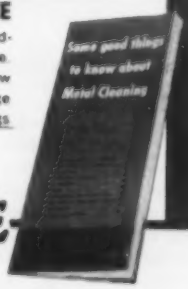

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make plans pay off with P-K

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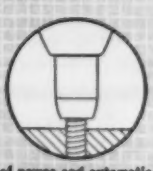
Save cost of tapping and tap equipment

Save cost of "two-side" fastening

Save cost of inserts for machine screws in plastics



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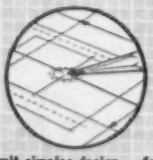

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For almost any assembly, you can plan cost-reduction from savings like these and many other advantages of Self-tapping Screws. But the promise of savings can fade in production if screw failure snarls up the line.

That's why quality standards for P-K Self-tapping Screws were set so high to begin with, and are still harder to match today.

Only Parker-Kalon can offer P-K experience —covering many more years and millions more applications than any comparable record.

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Plan your assemblies for lowest cost . . . a P-K Assembly Engineer will help you. Then purchase to *keep* cost down . . . order "P-K". Parker-Kalon Division, General American Transportation Corporation, 200 Varick Street, New York 14.

IN STOCK See your P-K DISTRIBUTOR

Screw faults are hard to see, but cost sheets and customer complaints soon show their effects — job slowdown, parts damage, high reclamation costs, loosening under vibration, hidden weakness.

P-K QUALITY STANDARDS PROTECT YOU against defective screws . . . *all* the P-K Screws you get are *Guaranteed First Quality.*

PARKER-KALON

The First **SELF-TAPPING SCREWS**

Remember **P-K** means **OK**

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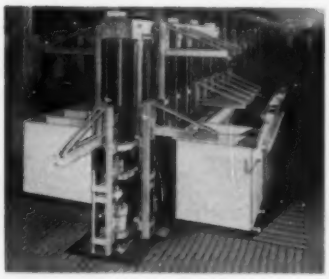
to get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

PRODUCT NEWS AND DEVELOPMENTS

PLATING AND PROCESSING MACHINE DESIGNED FOR HEAVY DUTY WORK



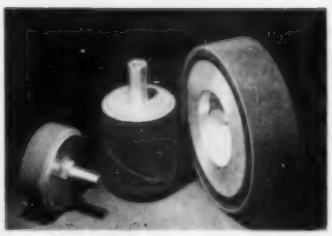
A new, fully automatic plating and processing machine has been introduced to the finishing industry.

This latest machine is a side arm type and was engineered around an "automation concept" that will enable automatic loading and unloading. It can be adapted to single or double row plating and processing and was designed to handle almost unlimited rack sizes and extreme weights. However, only a minimum amount of height and floor space is required.

The machine has a delayed set-down mechanism which allows independent timing in one or more tanks. It is mechanically flexible—additional transfers can be provided easily. Through the use of a special timer control, a carrier arm can be made to skip any particular tank or operation as desired.

Frederic B. Stevens, Inc.
For more information, circle No. 196 on the Reader Service Card

ABRASIVE BAND WHEELS IN VARIOUS SIZES & GRITS



Advantages reported for abrasive band wheels include: uniform finish is achieved because band wheel does not change in diameter, thus holding constant peripheral speed; variety of finishing jobs can be done simply by changing bands having different grits.

Now available in diameters from ¼" to 6", these bands are being stocked in more than 50 sizes, varying diameter and width. The wheel consists of a plated alloy steel shaft with flanges holding a specially fabricated rubber wheel. Abrasive bands can be quickly and easily slipped over a wheel. As the flanges are tightened, the squeezing action expands the rubber against the band to hold it securely.

Bands in stock include extra-flexible, special resin-bonded types, etc.

Even-Cut Abrasive Band Co.
For more information, circle No. 205 on the Reader Service Card

LEAD SCREW TAPPING UNIT IS ELECTRICALLY OPERATED AT HIGH SPEED

A new lead screw tapping unit is a self contained electrically operated and controlled device, specifically designed for fast precision single and multiple spindle tapping and threading. Utilizing a new principle of instantaneous acting forward and reverse electromagnetic clutches, no reversing motor is needed and the unit can be operated at extremely high speeds.

A built-in rheostat control which permits the clutch torque to be regulated over a range of from 0 to the equivalent of 2HP gives the unit the sensitivity required for the smallest taps yet assures sufficient power to drive the larger taps.

The clutches are energized within themselves so that there is no end pressure on either lead screw or taps, thus making possible greater accuracy. A depth control is included in the unit.

Ettco Tool Co., Inc.
For more information, circle No. 197 on the Reader Service Card

Continued on page 74

Luster-on®

The original bright conversion coating for zinc and cadmium

NOW PROUDLY OFFERS ALUMINUM PROTECTION

in either clear or colored finishes with

New **Luster-on®** Aluminum Sealer

- Replaces anodizing where hardness is not prime factor
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- Gives salt spray resistance to 600 hours
- Applies easily in one dip at room-temperature
- Adheres well, does not leach easily
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Send samples for free laboratory treatment. See superior results with your own eyes.

THE *Chemical* CORPORATION

66 WALTHAM AVENUE, SPRINGFIELD 9, MASS.

circle No. 62 on the Reader Service Card

MECHANICAL FINISHING MACHINE
. . . is semi-automatic in operation

A semi-automatic mechanical finishing machine for finishing a wide variety of different parts in a relatively short time cycle has been announced.

In operation, the parts to be processed are held in fixtures attached to the lower ends of vertically-mounted spindles which are mounted above a mass of abrasive or other finishing material. Spindles lower to submerge parts in the rotating mass. As the spindle submerges the part, it rotates, exposing all sides to the mass for uniform finish. Either wet or dry masses, ranging from large and very abrasive materials to small grain sizes may be used. Chrome steel balls may be used for coloring.

The machine is designed primarily for small lot production or experimental work. It is designed with a removable tub in which the finishing mass is contained and rotated. This feature allows the use of several tubs with different type of masses. Tubs can be changed quickly to allow change-over from one operation to another. Each tub is a complete unit with a built in sludge removal system.

Other features of the machine include change over of tubs without disturbing the drive mechanism and a variable drive for processing speeds from 100 to 500 fpm.

Roto-Finish Co.
For more information, circle No. 198 on the Reader Service Card

TAPPING HEAD
. . . has improved accuracy for long runs

Extensive field tests have shown, according to the manufacturer, that an improved model of a lead screw tapping head can maintain initial thread cutting accuracy over long production runs. On long runs the threads cut by this unit are reported to be 100% acceptable at final inspection.

A highly sensitive feed unit that is entirely automatic once started is said to be responsible for the high degree of accuracy achieved. Pressure in either the forward or reverse directions is eliminated by the unique clutch design so that thread contours are never distorted. At the end of the down stroke, the tap is reversed with no over-run.

In production threads have been uniformly cut at any pitch from 20 to 80 per inch. The depth is held constant within 0.005". Tap capacity is up to ¼" on soft materials and to 3/16" on hard materials. A class 3 fit is maintained easily on production.

Procunier Safety Chuck Co.
For more information, circle No. 199 on the Reader Service Card

BARREL FINISH COMPOUND
. . . made of fused alumina

A new abrasive product for barrel finishing is made from selected grades of aluminum oxide

Continued on page 77

CUT FINISHING COSTS THROUGH INCREASED PRODUCTION

Send for Free Literature Now!

SPRAY PAINTING MASKS
A competent engineering staff will counsel with you on the most efficient technique for handling your particular requirements.

PRODUCT DEVELOPMENTS BY C/M CONFORMING MATRIX

AUTOMATIC MACHINES
Increase production hundreds to one over hand methods. Reduce labor costs. Eliminate need of experienced workmen.

CLAMPS AND FIXTURES
Positive pressure and exact registration of the part in the mask. Reduce rejects. Free both hands for productive movements.

MASK WASHING MACHINES
50% faster than any other make. Cut solvent consumption. Avert production delays due to damaging of masks by hand scrubbing.

CONFORMING MATRIX CORPORATION
346 TOLEDO FACTORIES BLDG.
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ALWAYS FINISHES FIRST

—and saves on compound—it's "metered"!

Liquimatic®

the perfect liquid compound for all metal finishing

How much of the compound in your buffing room is wasted... in the nubbin pile, or in "over-heading" buffs? There's a way to "meter" the compound you use—the Liquimatic way. An electrically timed system in the Liquimatic Process feeds the exact amount of liquid compound for the exact cut you need. While compound is being saved, buffs are being saved too ...continual lubrication extends buff life up to 400%.

These two cost-saving advantages alone soon pay for a complete Liquimatic Application System. But there are still other ways Liquimatic will help you cut costs. No hand application, and no changing of bars will effect substantial down-time savings for you... and Liquimatic's ease of cleaning means even further economies. Now—when production must be upped, and costs lowered — profit from Liquimatic—over and over again.

Check the other features of Liquimatic ...then write today for your free copy of Liquimatic's big, new folder that tells the whole cost-saving story of Liquimatic in *your* buffing room.

These additional Liquimatic features mean real savings in terms of time, money, safety—

- longer buff life
- completely automatic
- fast cutting
- easy cleaning
- non-settling
- high flash point
- long storage life
- sprayable viscosity
- adhesive slow-wearing buff face

***Liquimatic* ...**

gives more buff mileage

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Your H-VW-M combination—of the most modern testing and development laboratory—of over 80 years experience in every phase of plating and polishing—of a complete equipment, process and supply line for every need.

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H-VW-M

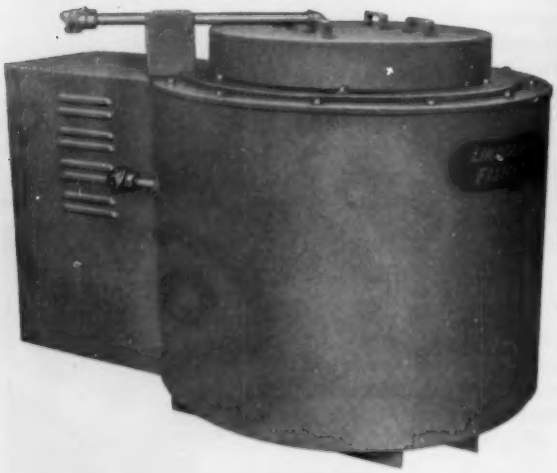
INDUSTRY'S WORKSHOP FOR THE FINEST IN PLATING AND POLISHING PROCESSES • EQUIPMENT • SUPPLIES

For more information circle No. 65 on the Reader Service Card

New From Lindberg-Fisher

For Permanent Mold and Sand Casting of Aluminum, Magnesium, Zinc and Lead.

A Lindberg-Fisher Electric Resistance Melting Furnace can mean lower cost per lb. of finished casting.



These furnaces eliminate localized heating of metal, eliminate gas absorption, because there are no products of combustion present. Higher production results, due to less operator fatigue. Exhaust fumes and smoke are nonexistent and radiation loss is held to an absolute minimum by use of high quality insulation.

Longer crucible or pot service and low furnace maintenance are obtained with the patented long life, low voltage elements.

Can also be used as a holding furnace on die casting applications.

Write for Bulletin No. 320

LINDBERG FISHER **MELTING FURNACES**

A Division of Lindberg Engineering Company

2463 WEST HUBBARD STREET, CHICAGO 12, ILLINOIS

For more information circle No. 30 on the Reader Service Card

Mow Down Your Grass Cutter Costs

Aluminum and Magnesium Die Castings

The increased use and acceptance by the public of power mowers has been tremendous . . . in large, this has been due to the choice by their manufacturers of lightweight aluminum and magnesium die cast parts. They help make these rotary and reel-type lawn mowers efficient and attractive, along with the attainment of competitive position in the retail market. Too, the savings in weight effected by these new lightweight alloys have an important bearing on consumer acceptance and save the manufacturer considerable in shipping costs. Greatly important to the manufacturer are the major production cost savings through the minimizing or virtual elimination of machining operations, plus the providing of smooth surfaces and design flexibility. As shown in the photograph, magnesium and aluminum alloy die castings have proved to be ideal for such lawn mower parts as: wheels, gears, gear housings, shaft housings, brackets, spacers, frames, cutter bar supports, etc.

Let's Talk It Over . . .

LITEMETAL DICAST, INC. is an organization of specialists — men thoroughly experienced in the casting and machining of magnesium and aluminum alloys. Our equipment includes big machines for big jobs — little machines for little jobs . . . the right sizes and types of the most modern die casting equipment for producing parts from the size of a button to large cable spools. Complete facilities for secondary operations are also available.

Write today for literature and design information. Quick action on inquiries.

LITEMETAL DICAST, Inc.

A DIVISION OF HAYES INDUSTRIES

1925 WILDWOOD AVE. · JACKSON, MICHIGAN

PLANT AND EXECUTIVE OFFICES

For more information circle No. 33 on the Reader Service Card

and processed to remove all sharp edges which might scratch the work. Sizes range from 2" down.

The success of this barrel finishing abrasive is said to be due to its toughness and its hard abrasive surface. It is made in an electric arc furnace from bauxite which is melted and forms hard aluminum oxide crystals with facets in every conceivable direction.

Constant use of the material does not impair the abrasive quality, but does somewhat reduce the size. Barrel finishing operations are said to be speeded up and quality improved with the new material.

The Exolon Co.
For more information, circle No. 200 on the Reader Service Card

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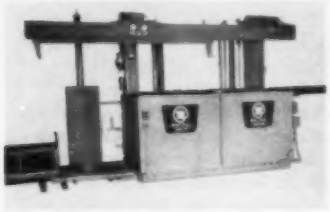
PARTS CLEANING MACHINE . . . has automatic cycling

A recent development in cleaning and washing machines has been introduced.



The new machine is designed for fully automatic operation after a basket of work to be cleaned has been placed in it. Work enters at floor level onto a lifting platform after which the entire cycle of lifting, washing and draining is entirely automatic according to a pre-set cycle; the cycle can be varied at will.

The machine is entirely air powered and is designed to fit into standard production lines. Special units can be built for any number of operations and for use with solvents, alkalies or acids. No separate foundation structure is needed.

Magnus Chemical Co., Inc.
For more information, circle No. 203 on the Reader Service Card

---

AIR OPERATED GRINDER . . . is extra high powered

An all new air operated grinder has recently been introduced. The new unit is said to combine light weight with the highest power

Continued next page

. . . switch to

UCON Hydrolubes
Trade-Mark

For maximum fire-resistance, maximum protection for men and machines, change to UCON Hydrolubes—CARBIDE's safety hydraulic fluids. Severe, exhaustive laboratory tests and 7 years' industrial use have proved their resistance to burning.

UCON Hydrolubes are balanced formulations. They contain modern synthetic lubricants and anti-wear agents for lubricity, water for non-flammability, effective liquid and vapor phase corrosion inhibitors for the protection of your equipment, an anti-freeze to keep the pour-point low (below minus 55°F).

You don't have to revamp your equipment to change to UCON Hydrolubes. They have no harmful effects on packings and seals . . . are supplied in a range of viscosity grades . . . have high viscosity indexes (150 to 160) . . . present no toxicity problems.

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UCON Hydrolubes *are products of . . .*
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A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.

Please send me the booklet "UCON Hydrolubes," Form 7380.

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Company_____ Position_____

Address_____

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"Ucon" is a registered trade-mark of Union Carbide and Carbon Corporation.

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For more information circle No. 19 on the Reader Service Card

aluminum . . .
▶ permanent mold castings
▶ die castings

EASTERN CASTING CORP. DIVISION
THE EASTERN MALLEABLE IRON CO.
64 South William Street, Newburgh, New York

4 TIMES GREATER DROSS/METAL **SEPARATION** in ZINC and ALUMINUM MELTING

WITH HAVILAND FLUXES

We have customers who are doing it now . . . separating *four times more metal from dross* with Haviland fluxes. They've found Haviland separated dross is so low in metal content that pulverizing or mechanical separation is both unnecessary and impractical! And they get better alloys, too.

FAST — even at lower furnace temperatures where other fluxes may fail.
SAFE — no dangerous, acrid, stinging fumes.
ECONOMICAL — you need less flux with Haviland . . . sometimes 50% less. You save both time and materials.

For free samples of Haviland fluxes for *your* zinc or aluminum melting operations, just drop us a line.

FREE BULLETIN — gives full information on these two new fluxes.
4B ALUMINUM FLUX — for use with all alloys and any type of furnace.
3G ZINC FLUX — complete alloy control . . . and extra metal savings.

Haviland PRODUCTS COMPANY
421 Ann Street, N.W. Grand Rapids 4, Michigan

Manufacturers of processing chemicals for the metal trades

For more information circle No. 74 on the Reader Service Card

NEW PRODUCTS—cont.

for a tool of this size on the market.

Other features of the grinder are permanently sealed bearings which eliminate the need for lubrication in the air line or the grinder itself. The nose piece is removable for extra deep grinding. The gyro action of the turbine imparts extreme stability to the unit making it easy to hold it steady.

The grinder is offered as a complete kit including an assortment of mounted points, a dressing stone, wrenches and a carrying case.

R. G. Haskins Co.
For more information, circle No. 211 on the Reader Service Card

METAL CUTTING COOLANT . . . does not stain aluminum

A new metal cutting coolant has been developed specifically for the machining and grinding of aluminum.

The new material is easily mixed with water to form a stable emulsion with a high degree of lubricity and detergency.

Through the use of this coolant a superior finish both in appearance and profilometer readings is said to be secured. The emulsion is non-reactive with aluminum dust and has been successfully used in large installations involving the use of central cooling systems.

International Chemical Co.
For more information, circle No. 201 on the Reader Service Card

LIQUID FILTER UNIT . . . has high capacity, small floor space

A new liquid filter unit that has a capacity of 800 GPH with either a stainless steel-cloth bag element or porous stone has been developed.

The compact unit is only 32" in diameter and requires 50" head room. All working parts are suspended underneath the tank to protect them from dirt and drippings. The units are constructed of extra low carbon stainless steel and are furnished with operating valves, motor and pump. Units are also available with all iron parts for use with alkaline solutions.

Bart-Messing Corp.
For more information, circle No. 202 on the Reader Service Card

PATENTS
continued from page 10

The feeding means including slug engaging fingers in the grooves of the channel members and a source of power for moving the fingers a fixed distance.

(Patent No. 2,704,388—Die Casting Apparatus — Vivian J. West and Frederick C. Stockham—assigned to The Wolverhampton Die-Casting Co., Ltd., Wolverhampton, England—Issued March 22, 1955).

A DEVICE FOR THE REDUCTION of iron oxides and particularly of iron ores in the solid state consisting of a cylindrical steel vessel, a reduction zone in the vessel, an encasement gas-tightly applied to the circumference of the vessel and extending throughout the height of the reduction zone and a pressure releasing means connecting the reduction zone with the inner space of the encasement.

(Patent No. 2,704,662—Device For the Reduction of Iron Oxides and Iron Ores—Friedrich Kocks—issued March 22, 1955).

APPARATUS FOR the electrostatic spray coating of articles. The patent covers both the electrostatic spray apparatus, including the generator and the charging means as well as the conveyor system for moving the articles to be coated past the spray gun.

(Patent No. 2,703,549—Apparatus for the Electrostatic Spray Coating of Articles. Edwin M. Ransburg—assigned to Ransburg Electro-Coating Corp.—Issued March 8, 1955).

TITANIUM BONDED diamond tools. The method of making an abrasive tool by using a plurality of thin discs of titanium metal powder by compression, at least one of which contains diamond powder. The discs are piled on each other with the one containing the diamond powder at one end of the assembly. The pile is then hot pressed to form a solid piece.

(Patent No. 2,703,750—Method for Making Titanium Bonded Diamond Tools—Perry G. Cotter—Issued March 8, 1955).

PRECISION CASTING. A method of making a refractory mould which includes the steps of coating the pattern with a mixture of finely divided refractory material and a non-toxic binder, applying to the coating while still wet a material in dry powdered form to roughen the surface, drying the coating, dipping the coated pattern in an ethyl silicate solution, drying the coated and treated pattern and investing with a slurry made by adding water to a dry mixture of at least 70 percent by weight of granular refractory material not reactive with water and the remainder consisting mostly of Portland cement. The invested pattern is vibrated to consolidate the investment, the excess water removed and the mold dried and baked.

(Patent No. 2,703,913—Joseph Hinde and Dennis Frederick Bernard Tedds — assigned to The Bristol Aeroplane Co., Ltd. Bristol, England—issued March 15, 1955).

circle No. 56 on the Reader Service Card

Tamms

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WRITE FOR PRICES

AMORPHOUS
CRYSTALLINE
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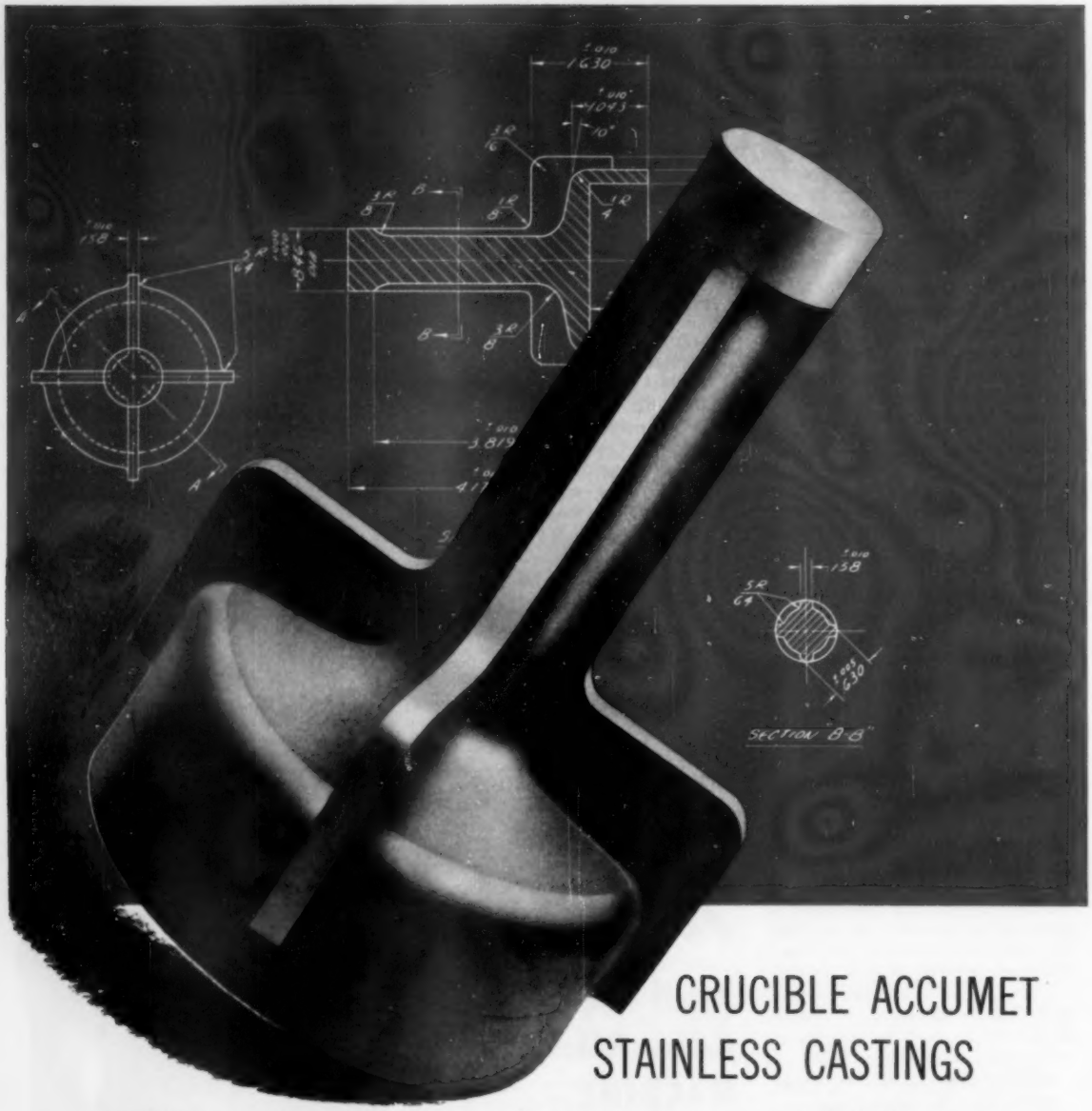

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To minimize finishing operations on your products, consider the advantages of ACCUMET precision investment castings. Let your Crucible representative show you how their close tolerances, fine finish, and physical and metallurgical accuracy can spell substantial savings for you. And — to see what information is available on these and other Crucible special steels, write for your free copy of the "Crucible Publication Catalog." *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

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NEWS OF INDUSTRY AND ASSOCIATIONS

TECHNICAL SUBJECTS OCCUPY SPRING MEETING OF INVESTMENT CASTERS

With coats off and sleeves rolled up, members of the Investment Casting Institute put in a busy two-day schedule at New York's Park Sheraton last month.

Technical papers ranging from recommended melting practices for small heats, to methods of getting quality pre-control of investment casting production, occupied the close attention of members during the first day of the ICI Spring meeting. Common industry problems, and a series of special projects on which the Institute is working currently, took the stage on the second day.

Four major committee reports showed considerable progress in Institute efforts to develop standard specifications for investment cast alloys, standard investment cast test bars, a proposed investment casting design and drafting manual, and methods for testing process materials.

Three tentative metal specifications have been drawn up by a technical committee headed by Charles Yaker, covering a carbon steel, a low alloy steel and a cobalt base alloy. These will be submitted for further study and discussion by ICI membership. A tentative identification system has also been set up for six categories of base materials: iron, copper, nickel, cobalt, aluminum and magnesium.

About a year and a half more of concentrated work is foreseen by the committee under B. W. Duncan, before definite results will be shown in developing standard test bars.

MORE THAN 800 ATTEND METAL POWDER SHOW; BOORKY NEW MPA HEAD

Members of the Metal Powder Association, meeting at their 11th Annual Meeting in Philadelphia, elected Morris Boorky president of the Association. Mr. Boorky is president of the Presmet Corp. and also chairman of the Fabricators Division.

B. T. duPont, Plastic Metals, Division of National-U. S. Radiator Corp., was elected chairman of the board; R. D. Ponemon, Pyroferric Co. Inc., chairman of the Iron Powder Electronic Core Division and vice-president of the Association; E. H. Klein, Metal Division, New Jersey Zinc Sales Co., was elected vice president and chairman of the Powder Producers Division. D. L. Alm-

Continued on page 88

SPEAKERS AND LISTENERS: On the rostrum at the ICI Spring meeting were the five speakers, left, who are (l to r) Dr. C. M. Adams of Massachusetts Institute of Technology; Dr. N. J. Grant, M.I.T.; James H. Moore, Vacuum Metals Corp.; Dorian Shainin, Rath and Strong; and V. S. Lazzara, Casting Engineers, Inc. Shown below are members of the Institute as they listened attentively to one of the several technical papers.

ANNOUNCES MAJOR REVISION IN STAINLESS STEEL DESIGNATIONS

The first major changes since 1952 in the published designations for stainless steel types have been announced by American Iron and Steel Institute. "These changes," according to Richard E. Paret, stainless steel specialist for the Institute, "are the result of improved industry practices and elimination of certain governmental controls. They now assure users even greater uniformity and dependability in these special requirement steels," Mr. Paret pointed out.

Standard types of stainless steels are numbered in the 300 and 400 series for the convenience of steel makers and users — to simplify their specification of these heat and corrosion-resistant steels. The last change in published designations was made in August, 1952, largely to comply with NPA orders to restrict the use of critical alloys.

Improvements in electrical furnace melting practices and more precise metallurgical controls are responsible for many of the analyses changes. Producers have been able to work to closer alloy limits, particularly on carbon, thus permitting a reduction in the maximum formerly permitted for some types.

The relative amounts of carbon, chromium and nickel are determining factors in corrosion resistance and physical and mechanical properties. Low carbon is required in most types for maximum resistance to corrosion, while higher carbon is employed for increased hardness, as in cutlery grades.

Six types have undergone changes in the maximum allowable carbon content provided for by the standard compositions. These are 301, 302, 302B, 316, 317 and 446.

Machinability received close attention, with the establishment of three new type numbers for selenium bearing stainless steels —303Se, 416Se, and 430F Se. Designers and fabricators now can specify by type number their free-machining stainless steel types with additions of sulphur or selenium.

Sulphur-bearing stainless steels are reported to be better suited for deep or heavy cuts; selenium types are preferred for shallow or light cuts.

EXPANSION UNDERWAY AT AUSTENAL

The Microcast Division of Austenal Laboratories, New York and Chicago, a producer of investment castings for industry, is expanding production facilities at its New Jersey plant with the construction of a new building at Rockaway Township.

The new facility, which is scheduled for completion in August, is expected to increase Austenal production 37 per cent, according to Paul Beier, plant engineer. The expansion will necessitate employment of an additional 200 persons, he said.

The new structure, together with equipment, will cost an estimated $600,000. It is being constructed of steel and brick with gypsum roof slate, and will contain 17,000 sq. ft. of work area.

The building represents the second major addition to Austenal's New Jersey facilities since construction of the original building in 1949. There have also been seven minor expansion moves since that time, bringing the total floor space, upon completion of the new unit, to 88,000 sq. ft.

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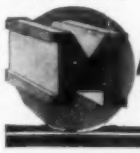

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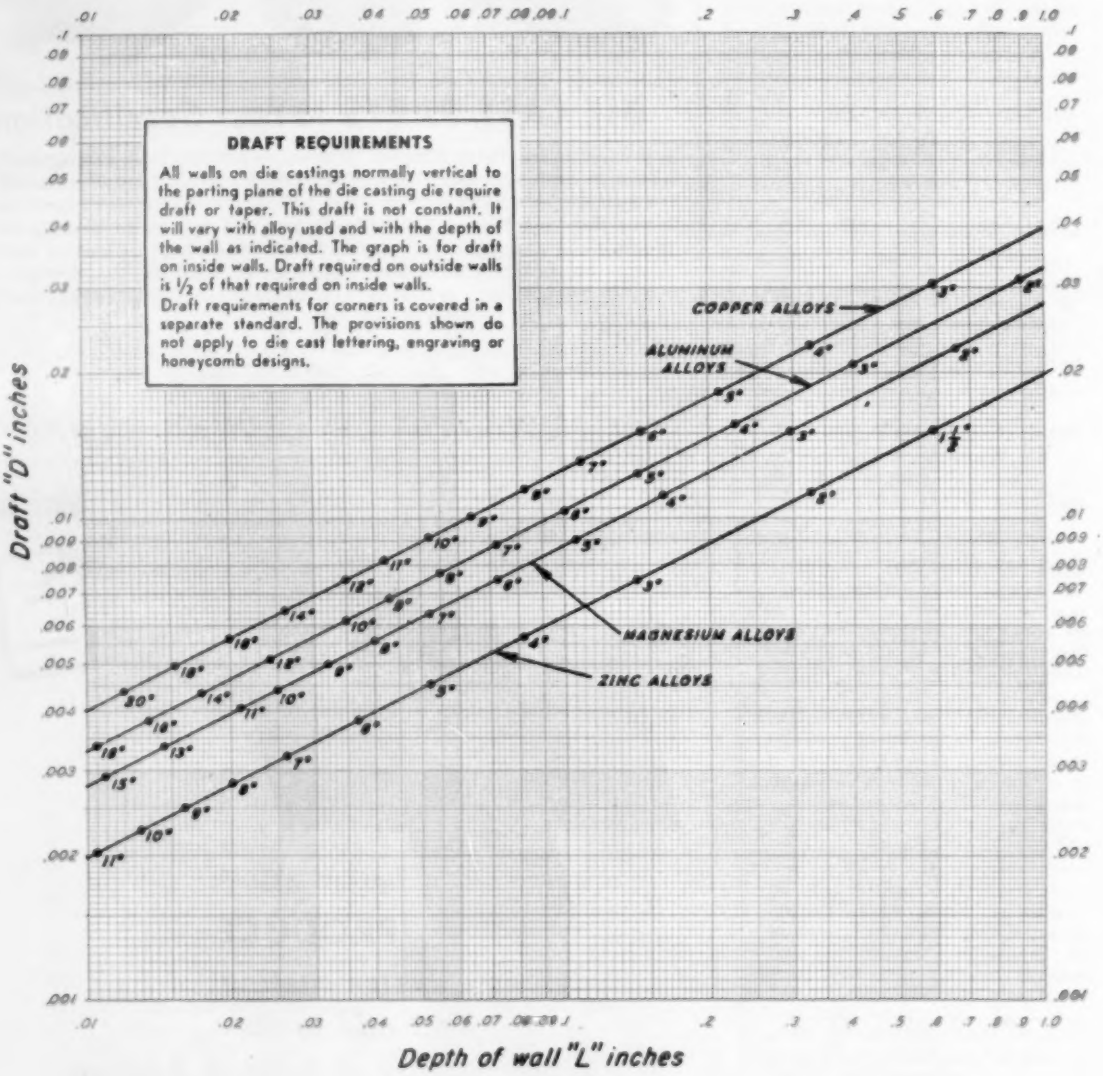
DRAFT REQUIREMENTS
All walls on die castings normally vertical to the parting plane of the die casting die require draft or taper. This draft is not constant. It will vary with alloy used and with the depth of the wall as indicated. The graph is for draft on inside walls. Draft required on outside walls is ½ of that required on inside walls.
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COPPER ALLOYS
ALUMINUM ALLOYS
MAGNESIUM ALLOYS
ZINC ALLOYS
Draft "D" inches
Depth of wall "L" inches

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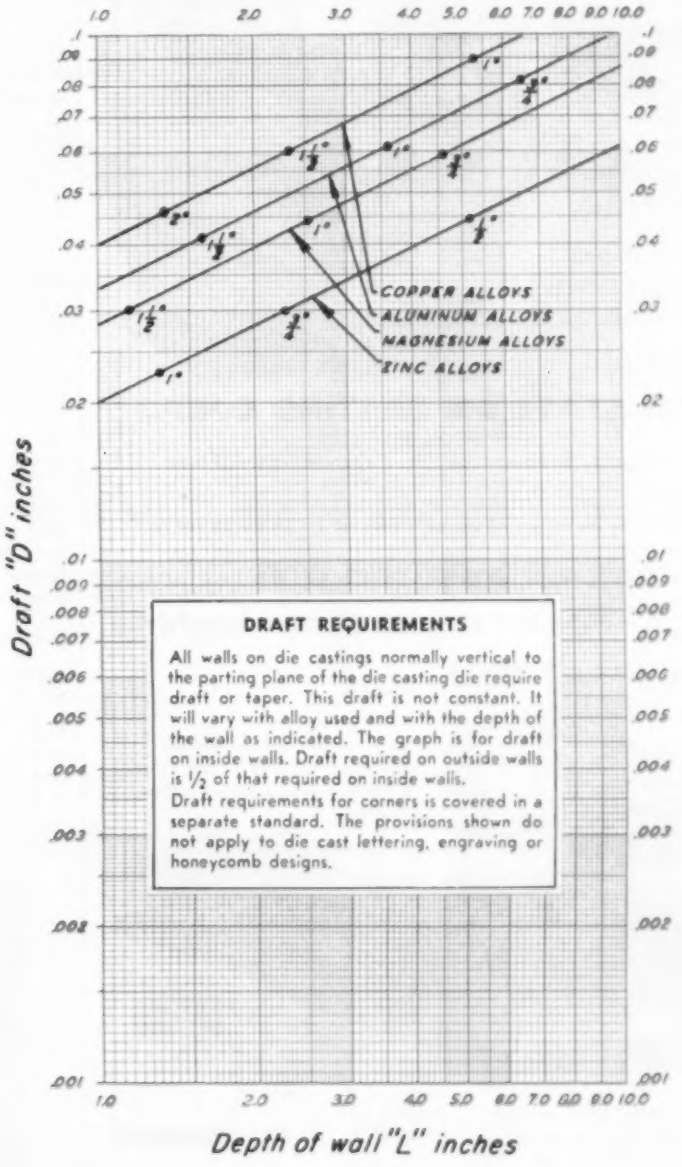

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are needed in the overall picture, overhead goes down.

Engineering time required to consult with vendors and approve or reject changes cannot be shown as a cost item, but none-the-less can increase or decrease the cost of manufacture. This same applies to minor tooling changes where, in most cases, the vendor will make them automatically with no need of consultation with the purchaser. If more than one vendor is involved, however, this cannot be done.

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ARWOOD PROMOTES W. O. SWEENY

The board of directors of Arwood Precision Casting Corporation have announced the election of William O. Sweeny to the position of vice president in charge of sales at their annual meeting.

William O. Sweeny

His responsibilities will encompass the sales and customer relations activities of Arwood's four plants at Groton, Conn., Tilton, N. H., Brooklyn, N. Y., and Los Angeles, Cal.

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Abrasive Belt Grinding: 186
The complete line of machines for grinding with abrasive belts is described and illustrated in a new catalog that has been published by the Grinding & Polishing Machinery Corp.

Burring Machine: 187
Using belts only 1" wide and either 42" or 12" long, two models of abrasive belt deburring machines are described in a leaflet from United Machine Tool Co.

Air Cushioned Contact Wheels: 188
A six page brochure from Nu-Matic Grinders, Inc. describes the air inflated contact wheels made by that company. Longer belt life and better finishing are claimed for the wheels.

Abrasive Belt Polishing: 189
Leaflets from Stephen Bader & Co. describe the several abrasive belt machines available for rough and finish grinding and polishing.

Polishing & Buffing Machine: 190
In a four page brochure, the Murray-Way Corp. describes and illustrates its heavy duty, multi-position polishing and buffing machines. Maximum flexibility, economy and efficiency are claimed for these units.

Backstand Idler: 191
A back stand idler for either floor or bench mounting and abrasive paper belts for micro finishing are described in literature that is available from the Fenlind Engineering Co.

Automatic Polishing & Buffing: 192
For parts to be buffed and polished that can be mounted and operated on a rotary table, Hammond Machinery Builders, Inc. offers a rotary automatic machine to grind, polish, buff and deburr. A descriptive pamphlet of the machine is available.

Yoke Sanders: 193
For grinding, polishing and deburring on inside and outside contours, Bush Mfg. Co. offers a narrow belt yoke type machine that can be mounted on bench, floor or wall. A descriptive brochure and price list are available.

Plating Equipment: 194
Filters, pumps, mixers and agitators and other plating room equipment are described and illustrated in catalogs from Alsop Engineering Corp.

Barrel Finishing: 195
Production barrel finishing in machines that require a minimum of floor space and can be tailored to fit available space are described in a brochure from Miller Machine Tool & Gauge Co.

Re-Rusting Compound: 197
A technical bulletin describing a new, non-electrolytic, de-rusting compound called Alka-Deox 114 has been prepared by Enthone, Inc.

Industrial Cleaners: 198
The story of industrial research and development in the metal cleaning field is told in a 16-page brochure entitled "Continued Story" published by Oakite Products, Inc.

Finishing Compounds: 199
A two page data sheet has recently been issued by Russell H. Burns Compound Co. describing and giving technical data on a full line of buffing, polishing and coloring compounds. Materials are described for operations ranging from deburring and chamfering to fine finishing of chromium plate and cutlery. Rouges are also described for jewelry, sterling or silver plate and for precision steel dies.

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HARDENING STAINLESS
continued from page 41

tempered hardness. It was found that on the parts in question a one hour draw at 1040 F gave the optimum results in meeting the hardness specifications of 32-36.6 Rc. Obviously, if section size and hardness specifications differ on other parts, some adjustment would be necessary.

A pilot run should readily indicate the direction and extent of any such adjustment from the curves of Figure 3. Attention is drawn, however, to the slope of these curves. The drop in hardness is rapid during the initial tempering time intervals. This fact must be borne in mind, especially for higher draws, as slight variations may cause pronounced hardness changes.

In conclusion, the following general recommendations are made for consistent results on small 410 stainless investment castings: (a) adhere to adequate annealing procedures with respect to time and temperature; our experience shows this to be the most critical step in obtaining uniformity of final results, (b) employ correct hardening temperatures, (c) oil quench, (d) once established, control the time and temperature of the draw closely.

MPA MEETING
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quist, Stackpole Carbon Co., chairman of the Ferrite Division and vice president. W. A. Irvine, Maytag Co.; L. W. Davis, Metal Hydrides Inc., and H. E. Hall, Metals Disintegrating Co., were elected to the Board. The balance of the Board consists of Harrison Stackpole, Stackpole Carbon Co., and Carl Johnson of Presmet.

Significant at MPA meetings this year, was the trend toward papers of a more technical nature. Some of the basic problems that have been bothersome to both producers and consumers of parts made from metal powders were discussed and solutions suggested.

Between 800 and 900 persons registered for the exhibits, marking a new high for attendance.

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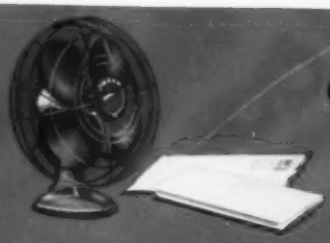

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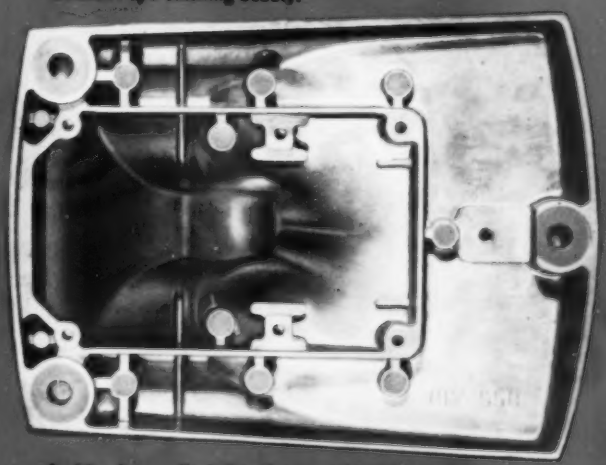

Inside: A complicated pattern precisely reproduced.

Changing from a cast-iron to a die cast base for one of their popular fan models has resulted in 10 specific benefits for this highly-pleased manufacturer.

Here they are, according to a company spokesman:

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   a. A grinding operation to remove flash on the cast-iron neck.
   b. Heat treatment and sand blasting.
2. The elimination of spoilage due to breakage caused by chilling and/or hard spots.
3. The elimination of filling rough spots found in cast-iron castings.
4. The elimination of tapping four holes in the cast-iron bases. Die casting makes possible the use of self-tapping screws because of the softer metal involved.
5. Lighter die-cast bases make assembly line operations easier—save time.
6. Lighter die-cast bases provide a freight charge saving in the shipment of finished goods.
7. Lighter die-cast bases make stock room work easier—save time.
8. Die-cast bases, when stocked prior to entering our production line, are easier to stack because of more uniform base thicknesses—save time and storage space.
9. The smoother surface of die-cast bases, allow the usage of a smooth enamel paint—eliminate costly repainting.
10. Die-cast bases give a consistent quality with a high daily productive capacity.

How about something you're making?

Hoover's specialized skill, complete facilities and cost-wise production methods may help you, too, save a lot of money.

Call in a Hoover Engineer and talk it over before you finalize your plans. For informative booklet, "Die Castings", write:

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THE HOOVER COMPANY
DIE CASTINGS DIVISION,
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APEX

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die casting alloys

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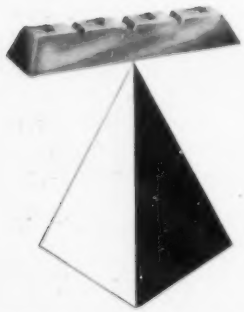

RESEARCH LEADERSHIP BACK OF EVERY INGOT

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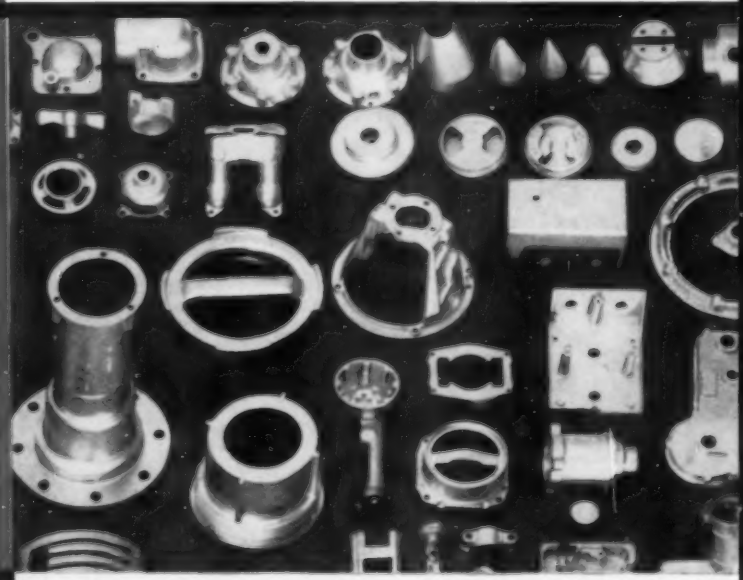

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